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Are Corporate Spin-offs Prone to Insider Trading?

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ABSTRACT

Despite abundant empirical evidence of informed trading ahead of major corporate events, no such evidence has been reported in the case of corporate spinoff (SP) announcements. This is surprising, as SP announcements are unexpected, and are also associated with a positive price jump in the parent company's stock. Using a sample of 280 U.S. announcement events from 1996 to 2013, we document significant pre-announcement informed trading activity in options for about 9% to 16% of events in our sample. In contrast, we find statistically insignificant evidence of informed trading in stocks, suggesting that informed traders employ leverage through options. In light of the mixed evidence about the effect of SP announcements on a parent firm's credit risk and its debt, we also test for the existence of pre-announcement informed trading activity in bonds and credit default swaps, but find no support for such a conclusion.

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While there is considerable evidence of informed trading ahead of a variety of corporate announcements in the academic and popular literature, there is no reported evidence for the period preceding corporate spinoff (SP) announcements, which pertain to the sale of a subsidiary or the division of a company as a separate entity. This is surprising since SPs are generally publicly unexpected, largely unpredictable, and accompanied by an upward jump in the parent firm's stock price. Concurrently, there may also be a drop in the parent's bond prices, possibly due to a wealth transfer from the parent's bondholders to its shareholders (Maxwell and Rao, 2003; Parrino, 1997), although the evidence on this occurrence is mixed and debated (Hite and Owers, 1983; Veld and Veld-Merkoulova, 2008).[1] The stock and (potentially) bond price reactions in opposite directions make SPs unique, and allow for a joint hypothesis of informed trading on multiple securities traded on the same firm.

The objective of our study is to explore the possibility of informed trading in corporate securities and derivative instruments associated with SP announcements. In particular, we investigate and quantify the pervasiveness of informed trading, some of it possibly based on inside information, in the context of SP activity in the United States (U.S.), using a sample of 280 SP announcement events from January 1996 to December 2013.

The study of informed trading is only relevant if there are economic gains from trading on private information to begin with. The first step in our research is, therefore, to revisit the evidence on cumulative abnormal returns (CARs) of parent companies' stocks around SP announcements. We document a statistically significant average CAR of approxi-

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[1] One prominent example is the sale by General Electric of its GE Capital division on April 10, 2015, which led to a jump in the parent's share price of nearly 11%, together with a cut in GE's debt rating by Moody's Investors Services. See "GE Seeks Exit from Banking Business,"*The Wall Street Journal*, April 10, 2015.

mately 1.62% to 2.53%. This is similar in magnitude to the price reaction around earnings announcements (Foster *et al.*, 1984) and is, therefore, economically meaningful. The distribution of CARs is also right-skewed, with many SP announcements recording CARs in excess of 5%.

We also investigate whether the positive CARs earned by the parent's shareholders are accompanied by negative CARs for the parent's bondholders. This analysis is based on quote and transactions data on the parent companies' corporate bonds, and pricing information on the credit default swap (CDS) spreads written on these bonds. We find no evidence of CARs in the cash bonds of the parent firm. On the other hand, we find evidence of positive CARs in the CDSs around SP announcements ranging from 3.95% to 6.23%, reflecting an increase in credit risk. The evidence for an increase in the parent's credit risk following the SP announcement is thus mixed.

We then examine trading in multiple securities based on different parts of the firm's capital structure, including stocks and bonds, as well as derivative instruments based upon them, such as equity options and CDS contracts. Thus, we use SPs as a laboratory to test for the preferred trading venue for informed traders across different types of cash and derivative markets.

Given that companies may self-select into SPs, our tests may be biased due to potential endogeneity. To mitigate this possibility, we build a SP prediction model and construct a propensity-matched control sample in order to compare abnormal trading activity in the sample of SPs (the treatment group) with that of a control group that is optimally matched based on company and industry characteristics and financial performance. We construct two measures of informed trading following Acharya and Johnson, 2010, the so-called *Sum* and *Max* measures. Using various benchmark regression models to capture "normal" volumes and returns in a three-month estimation window preceding SP announcements, these measures are computed using the sum of all positive (*Sum*) or the maximum of all (*Max*) standardized residuals, over the five days immediately preceding the announcement day. In other words, *Sum* and *Max* reflect abnormal activity in both the stock and the options market, arising either from unusually large spikes in trading activity on individual days, or from large CARs and volumes in the pre-event window.

Irrespective of the particular measure used, and the construction of the control sample, we find robust evidence of informed trading in the equity

options, but not in the stocks, of parent companies, in the five-day window preceding corporate SP announcements. This trading activity is reflected in abnormal options volume and excess implied volatility, although we find little evidence of abnormal stock volume or abnormal stock returns. This suggests that the options market is the preferred venue for informed investors in the context of SPs, perhaps due to its lower leverage-adjusted transaction costs. In addition, we find that the abnormal options volume is relatively larger for call options than for put options, in particular for out-of-the-money (OTM) and at-the-money (ATM) call options. In an attempt to quantify the pervasiveness of informed trading activity using different benchmark models, we find that between 9% and 16% of all the announcement events in our sample exhibit statistically significant abnormal options activity in the pre-announcement period at the 5% significance level.

We also find that abnormal options activity in the pre-announcement period is more pronounced in subsamples of divestitures that are, ex ante, expected to have greater CARs. Thus, we find a greater degree of unusual options volume, for example, for SPs that are eventually completed, for those instances where the divested company is operating in a different industry than the parent, and for cases where the deal value reflects a greater fraction of the market capitalization of the parent firm. Nevertheless, the differences across sub-samples sorted on deal characteristics are not statistically significant.

The evidence that it is only abnormal pre-announcement options activity that positively and robustly predicts CARs offers additional support for informed trading in the options market, but not in the stock market. While the analysis of total volumes signals abnormal trading activity, we perform a direct test on trading intentions to pinpoint the information content in trading volumes. In a restricted sample of SP announcements, we confirm our previous evidence using high-frequency, tick-by-tick data in the stock and options markets. We find that net buying activity in the options market, measured as the net difference between buyer- and seller-initiated option exposures to the underlying stock price (order flow imbalance), is significantly greater in the treatment sample than in the propensity-matched control group, while this is not the case for stock order imbalance.

We also examine the possibility that informed investors may trade in the parent company's bonds and CDS contracts prior to the SP announcement. However, we find no statistically significant difference in the measures of informed trading, for the bond and CDS markets, between the SP

sample and the propensity-matched control group. Thus, in the context of corporate divestitures, the preferred venue for informed trading appears to be the equity options market. This may be rationalized using a back-of-the-envelope calculation, as being due to the trade-off between leverage and transactions costs (liquidity), relative to other venues.

1 Literature Review and Contributions

Our work relates primarily to the empirical literature on informed trading around corporate announcements, including earnings announcements (Patell and Wolfson, 1979; Patell and Wolfson, 1981; Billings and Jennings, 2011; Kaniel *et al.*, 2012; Jin *et al.*, 2012; Goyenko *et al.*, 2014), mergers and acquisitions (M&As) (Cao *et al.*, 2005; Chan *et al.*, 2015; Augustin *et al.*, 2018; Lowry *et al.*, 2018), bankruptcies (Ge *et al.*, 2016), the 9/11 terrorist attack (Poteshman, 2006), leveraged buyouts (Acharya and Johnson, 2010), analyst recommendations (Hayunga and Lung, 2014; Kadan *et al.*, 2018), stock splits (Gharghori *et al.*, 2017), and share repurchase announcements (Hao, 2016).[2] The question of the venue where informed investors trade has also been studied extensively, from a theoretical perspective, taking into consideration asymmetric information (Easley *et al.*, 1998), differences in opinion (Cao and Ou-Yang, 2009), short-sale constraints (Johnson and So, 2012), and margin requirements and wealth constraints (John *et al.*, 2003).

We provide three main contributions to the literature on informed trading. To the best of our knowledge, we provide the first evidence of informed trading in the period preceding SP announcements. By highlighting another natural setting for testing the existence of informed trading, we contribute to the academic and public debate on insider trading before corporate events. Second, we examine informed trading *across* different asset classes: stocks, options, bonds, and CDSs. Most studies on informed trading cited above typically examine one asset class in isolation, apart from Acharya and Johnson, 2010, who relate the likelihood of insider trading in debt and equity markets to the size of debt and equity syndicates in leveraged buyouts. Third, we provide a methodological contribution as we formally show under what assumptions the informed trading measures

[2] Bhattacharya, 2014 surveys the studies on insider trading.

Sum and *Max* of Acharya and Johnson, 2010 can be used for statistical inference.

We also contribute to the literature on a parent's short-term stock price reaction to corporate SP announcements, as we review the evidence from earlier studies using a sample of 280 unique event days over the 1996 to 2013 sample period. Veld and Veld-Merkoulova, 2009 summarize the results of 26 studies with research periods ranging between 1962 and 2005. They report the CARs to be 3.01% on average, and ranging from 1.32% to 5.56%.

Multiple reasons have been put forth to rationalize positive excess returns, including enhanced investment efficiency of the parent (Ahn and Denis, 2004), contracting efficiency (Hite and Owers, 1983), an improvement in operating performance (John and Ofek, 1995), a wealth transfer from bondholders to shareholders (Maxwell and Rao, 2003; Veld and Veld-Merkoulova, 2008), an improved allocation of capital (Gertner *et al.*, 2002), reversals of value destruction from earlier acquisitions (Miles and Rosenfeld, 1983; Allen *et al.*, 1995), industry focus (John and Ofek, 1995; Daley *et al.*, 1997; Dasilas *et al.*, 2011), reduced information asymmetry (Habib *et al.*, 1997; Krishnaswami and Subramaniam, 1999; Martin and Sayrak, 2003), and tax and regulatory considerations (Schipper and Smith, 1983; Copeland *et al.*, 1987). Across these studies, the results tend to be stronger for larger deals (Klein, 1986) and deals that are not completed. The argument for industry focus is closely tied to the conclusion of a conglomerate discount (Berger and Ofek, 1995), which has been confirmed by several researchers (Burch and Nanda, 2003; Laeven and Levine, 2007; Hoechle *et al.*, 2012; Lamont and Polk, 2002), but was also challenged (Custodio, 2014).

2 Data and Spinoff Announcement Returns: Evidence Revisited

We begin by revisiting the evidence on the CARs around announcements of corporate SPs in the U.S. We obtain the SP sample from the Thomson Reuters Securities Data Company Platinum Database (SDC) for the January 1 1996, to December 31, 2013 period. The start date of our sample is dictated by the availability of options data. We source all corporate SPs with a U.S. parent company from the domestic M&A dataset in SDC, yielding a total of 1,165 SP announcements that correspond to 1,105 unique

event days during our sample period.[3] We then remove deals that are flagged with a pending or unknown status, and retain only public parent companies with matching stock price information in the Center for Research in Securities Prices (CRSP) database. In order to avoid the confounding effects of multiple events for the same parent company, we require that no other SP divestiture announcement occurred within a three-month window prior to the event; if this was the case, we only keep the first occurrence in our sample. The combination of these selection criteria generates a sample of 446 corporate SP transactions, reflecting 426 unique event days during our sample period.

To construct propensity-matched control groups for our analyses, we also require information about the stock and option prices and volumes, as well as firm characteristics. Therefore, we extract daily price and volume information for stocks from CRSP, for options from OptionMetrics, and balance sheet information from Compustat, resulting in a sample of 295 SPs and 280 unique event days during our sample period.

Table 1 provides the number of corporate SP announcements by calendar year, as well as statistics on the transaction values of the SP companies. Specific information on the deal value is available for 186 of the deals (63%). There were a greater number of divestitures in the 1990s, with a low of 24 in 1996, and a peak of 36 in 2000; there was more muted SP activity after 2001, ranging from 4 per year in 2004 to 20 per year in 2011. For the average divestiture, the size, measured by market volume, is approximately $4.1 billion. However, there is a large degree of cross-sectional variation, reflected in an average sample standard deviation of $11.5 billion. The smallest divestiture has a value of $3.4 million and corresponds to the SP by General Magic Inc. of its Data Rover division in 1998. The largest deal in the sample is by Altria Group Inc. of Kraft Foods Inc. on August 29, 2007 and valued at $107.6 billion. Out of the 295 deals in our sample, 136 (71) deals/46% (24%) have the divested subsidiary in the same industry as the parent company, as characterized by the two-digit (four-digit) SIC code. There are 121 deals (41%) whose divested subsidiary is in a different state than the parent company's headquarters.

[3] If a parent company spins off several subsidiaries/divisions on the same day, we count them as one event and aggregate their deal values. The subsidiary industry is coded to be different from the parent if any of the subsidiaries is in a different industry than the parent. The physical distance associated with the event is assigned the largest distance between the headquarters of the parent and any of its subsidiaries.

For a subsample of events, we also require information on order flows, and extract tick-by-tick price and volume information for stocks from the NYSE Trade and Quote (TAQ), and for options from the Option Price Reporting Authority (OPRA). The OPRA data from Trade Alert LLC. is available only since April 2006. These additional requirements reduce the sample size to 94 deals from 2006 to 2013. We use this smaller sample only for the order imbalance tests, while our main analysis of informed trading is based on a larger sample of 280 events for which the parents have traded options.

Maxwell and Rao, 2003 document that bondholders experience, on average, a negative abnormal return of 88 basis points (bps) during the month of the SP announcement, while Veld and Veld-Merkoulova, 2008, who find positive bond CARs of 0.11% over a three-day event window, argue that large negative numbers may be due to outliers. We thus review the evidence on the negative CARs on the parent company's debt around SP announcements, using information from both the cash and the derivative fixed income markets. For the cash market, we obtain company identifiers from Mergent FISD, which allow us to match all parent companies in our sample with bond transactions information from the Trade Reporting and Compliance Engine (TRACE).

A few comments about our sample size are in order. Given that liquidity in the corporate bond market is comparatively much lower than in the stock market, we identify only 49 parent firms with active bond issues in the estimation window around the announcements. While this is seemingly a modest-sized sample, it compares favorably with that of Kedia and Zhou, 2014, who only have a sample of 329 bonds issued by 123 firms in the context of (more frequent) M&As, and Acharya and Johnson, 2010, who examine only 34 private equity buyouts. As our sample size is modest, we also source daily bond quote data from Bloomberg and Datastream, for which we can match the company identifiers with 52 and 37 announcements, respectively, providing us with a slightly larger sample.

For the fixed income derivatives market, we rely on CDS data from Markit. We use the most liquid five-year senior unsecured CDS spreads and report results based on the modified restructuring (MR) clause, given that it used to be the standard North American contract, by convention, prior to the Big Bang Protocol in 2009.[4] We identify 54 firms with valid

[4] See Augustin *et al.*, 2014 for details. Results using contracts with the no-restructuring

CDS quote information around the SP announcements during the 1996 to 2013 sample period.

2.1 Abnormal announcement returns for stocks

We first compute, for the parent companies, the CARs around SP announcements for the 280 unique SP event days in our sample. We use the Fama and French, 1993 three-factor model (FF3F), which includes the market return (R_m), as well as the market-to-book factor (MB), and the high-minus low size factor (HML), but also report results for the nested market model that only includes the market return. More specifically, for each SP, we first compute abnormal returns ($AR_{i,t}$) as the regression residuals from the projection of realized returns $R_{i,t}$ on expected normal returns, i.e., $AR_{i,t} = R_{i,t} - \hat{\alpha}_i - \hat{\beta}_i R_{m,t} - \hat{\gamma}_i MB_t - \hat{\delta}_i HML_t$. All parameters of the expected return model (α, β, γ, and δ) are estimated over an estimation window $[T_1, T_2]$ running from $t = -252$ to $t = -21$ relative to the announcement day, which is defined as day $\tau = 0$. Parent-specific ARs are then aggregated over different event windows $[\tau_1, \tau_2]$ to obtain CARs, defined as $CAR_i(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} AR_{it}$. Specifically, we examine the CARs on the announcement day, as well as the following event windows, [-1,0], [-1,1], [-1,2], [-1,5], and [-1,10]. Inference is based on the cross-sectional average CAR, defined as $\overline{CAR}(\tau_1, \tau_2) = \sum_{i=1}^{N} CAR_i(\tau_1, \tau_2)/N$, where N denotes the number of unique SP event days.[5]

In Table 2, we show that unconditional $\overline{CAR}$s are always statistically significant, across event-windows, at the 1% or 5% significance level, except for the ten-day CARs using the market and the FF3F models (significant at the 10% significance level) and the five-day CAR using the FF3F model. Apart from the longer-horizon metrics reported in columns (5) and (6), the lowest $\overline{CAR}$ is 1.62% for the announcement day using the FF3F-adjusted returns, but it is as high as 2.53% in the three-day event window [-1,1] using the market model. Although these values are not as large in

(XR) clause, which became the standard North American contract after the Big Bang Protocol, are quantitatively similar.

[5] We find similar results using (1) a four-factor model that includes the Carhart, 1997 momentum factor, and (2) alternative estimation windows following Kothari and Warner, 2007.

magnitude as for targets of tender offers in M&As, they are sizable and economically similar to the numbers reported for average CARs surrounding positive earnings announcements (Foster *et al.*, 1984), another common corporate announcement. Looking at the distribution of the FF3F CARs on the announcement day in Figure 1, it can be seen that the distribution is right-skewed, with a substantial fraction of events having positive CARs of 5% or higher. The majority of events have positive CARs, but there are also a number of events with negative CARs.

Our findings confirm previous evidence of positive economic gains earned by the shareholders of parent companies upon the announcement of a corporate divestiture (Veld and Veld-Merkoulova, 2009). Earlier studies have highlighted cross-sectional differences in short-term CARs that are associated with company characteristics. However, our (unreported) examination lends no statistical support for the conclusion that CARs are significantly higher for cross-industry SPs [conglomerate discount (Burch and Nanda, 2003; Laeven and Levine, 2007)] or completed deals. Despite the idea that proximity facilitates information acquisition and reduces monitoring costs (Coval and Moskowitz, 1999; Coval and Moskowitz, 2001; Petersen and Rajan, 1994; Mian, 2006; Sufi, 2007; Lerner, 1995; Giroud, 2013), we find no evidence that co-location in the same state and/or geographical distance affects CARs. There is some support for the notion that CARs are greater when the enterprise value of the subsidiary represents a larger fraction of the parent (Hite and Owers, 1983). In our sample, the average (median) SP accounts for approximately 35% (25%) of the parent's market capitalization.

2.2 Abnormal announcement returns for bonds

Since bonds trade only infrequently, we follow Acharya and Johnson, 2010 and form bond portfolios using all outstanding bonds of the same firm, weighted by issue size, to compute their daily returns. All returns include accrued coupon interest, where the information on coupon structures is obtained from FISD. For the fixed income announcement effects based on the derivative market, we compute the simple difference in logs, i.e., $RET^{CDS}_{t,t+1} = \ln(CDS_{t+1}) - \ln(CDS_t)$, given that these provide a reasonably good approximation (Hilscher *et al.*, 2015). As an alternative measure, we compute daily holding period excess returns following Lee *et al.*, 2016. This CDS return, from the perspective of a protection buyer, is calculated

as the change in CDS spreads multiplied by the risky present value of a basis point, $RET^{CDS}_{t,t+1} = (CDS_{t+1} - CDS_t) \cdot RPV01_{t,t+1}$, where $RPV01_{t,t+1}$ fully incorporates all accrued premium payments.

In Panels B, C, and D of Table 2, we report the results for cash bonds using the TRACE, Datastream, and Bloomberg data, respectively. The $\overline{CAR}$s range from -0.08% to -0.03% on the announcement day, and from -1.18% to 0.36% for the other event windows. However, we find that none of the test statistics is statistically significant. The theoretically equivalent counterpart of a corporate bond spread is a CDS spread (Duffie, 1999), which is often based on a more liquid market and generally leads the cash market in price discovery. We, thus, compare our cash bond results with those obtained using simple and "clean" CDS price returns in Panels E and F of Table 2. For simple returns, the $\overline{CAR}$ is 6.23% on the announcement day, statistically significant at the 5% level, and ranges from 4.54% to 6.01% across the other event windows. For "clean" price returns, the magnitude of the CAR on the announcement-day decreases slightly to 4.79%, and the CARs fluctuate between 3.95% and 4.87% throughout the other event windows. The test statistics are mostly significant at either the 5% or 10% level. As positive CDS returns indicate an increase in credit risk, these results reflect negative returns for investors with a long credit risk exposure towards the parent firm.

We thus find mixed evidence of CARs in the fixed income market. While the insignificant bond results are more consistent with Veld and Veld-Merkoulova, 2008 and Hite and Owers, 1983, the CDS results appear to be consistent with Maxwell and Rao, 2003, who suggest that economic gains from divestitures accruing to shareholders may reflect an expropriation of shareholder wealth. As the results are mixed, we study the preferred venue for informed trading across cash and derivative markets, for both equity and debt.

3 Informed Trading before Corporate Divestitures

We first discuss our research questions and hypotheses (Subsection 3.1). We then provide some preliminary evidence on pre-announcement informed trading activity (Subsection 3.2), illustrate how we measure informed trading (Subsection 3.3), and discuss the construction of propensity-matched control groups for the main part of the analysis (Subsection 3.4).

3.1 Research questions

Corporate SP announcements are normally unexpected and typically exert a positive effect on the stock price of the parent, just as the price of the target goes up in response to an M&A announcement, albeit by a lower magnitude, and with somewhat less certainty. Despite substantial anecdotal evidence of informed trading prior to M&A announcements, there is paucity of evidence for corporate divestitures, even though the nature or private information is similar in both cases and well identified. Thus, we investigate the presence of informed trading ahead of SP announcements.

We are also interested in investigating where informed investors trade. Easley *et al.*, 1998 model informed traders' choice between the stock and options markets in the presence of asymmetric information. They show that, under certain conditions, some investors will choose to trade in the options market. Mixed trading strategies in both the stock and options markets may also arise in the presence of margin requirements and leverage constraints (John *et al.*, 2003). Cao and Ou-Yang, 2009 and Johnson and So, 2012 suggest that options trading should be concentrated around information events, while Cao *et al.*, 2005 show that the options market displaces the stock market as a venue for informed trading ahead of M&As. The positive CARs are typically smaller for SPs than for M&As. Thus, we expect that informed investors have a stronger motive to trade in the options market, as they would benefit more from the leverage effect obtained from options trading.

Given that the stock prices of parent companies typically rise after SP announcements, we examine whether the evidence is consistent with directional trading in the options market. The simplest way to implement a levered directional trading strategy is to purchase plain vanilla call options. Hence, we test for the presence of unusual activity in the options market for both call and put options. As there is more uncertainty about the magnitude of a SP CAR, an informed trader may trade less out-of-the-money (OTM) calls compared to a case where (s)he is more certain about a large announcement effect. Thus, we also examine whether there is a relatively greater amount of abnormal trading volume in OTM than ATM or ITM call options, given that OTM call options provide greater leverage than an equal dollar investment in either an ATM or ITM call option. Leverage is a relevant consideration for a wealth-constrained investor, who cannot borrow easily.

The evidence on fixed income SP CARs is mixed, both in the literature (Maxwell and Rao, 2003; Veld and Veld-Merkoulova, 2008) and in our sample. We, therefore, examine pre-announcement informed trading activity for the parent's bonds and CDSs. We find no statistical support for either positive or negative CARs for parents' cash bonds, but we do for CDS contracts. This may be due to the leverage they offer, especially as it is more difficult and expensive to short bonds than it is to short stocks.

3.2 Preliminary evidence of informed trading

To provide preliminary evidence on pre-announcement informed trading activity across asset classes, in Figure 2, we plot the CARs and excess implied volatility (a metric of the option "return"), computed using the FF3F model as a benchmark, over the 20-day period preceding the SP announcements. The figure displays no discernable pattern of unusuable pre-announcement activity in stocks, bonds, or CDSs. On the other hand, there is a pronounced run-up in the measure of cumulative excess implied volatility. These findings lend support to the conclusion of unusual pre-announcement activity in options, but not in stocks, bonds, or CDSs.

3.3 Measuring informed trading

To measure informed trading activity in stock and options markets ahead of corporate SP announcements, we follow Acharya and Johnson, 2010, and construct the *Sum* and *Max* measures, two measures of informed trading designed to capture unusual and suspect activity in the stock and options markets. The *Sum* and *Max* measures are, intuitively speaking, metrics of abnormal volume and returns, computed relative to a benchmark model that predicts expected returns and volume in a two-stage procedure. To capture unusual price effects in the options market, and to study excess implied volatility, we use the average implied volatility of the 30-day ATM call and put options from OptionMetrics. More precisely, in the first stage, we fit for each of our variables a normal regression model over the 90-day pre-announcement window to compute normal returns, similar to what we did for abnormal returns as described in Subsection 2.1: the conditional model contains a constant, day-of-week dummies, lagged returns, and volume, as well as contemporaneous returns and volume of the S&P500 Index. In addition, we account for lagged values of the dependent

and all independent variables and the VIX price index. We explored other less conservative models, which mostly yield stronger results, suggesting that our findings are conservative.[6] We use only pre-announcement information in order to not confound the measures of informed trading with activity arising from the announcement effect itself.

In the second stage, we standardize the residuals from the normal return regression using the standard deviation of all residuals. The standardized residuals from the five-day period immediately preceding the SP announcement day are used to compute the *Sum* and *Max* measures. The deal-specific *Sum* measure is constructed by aggregating all positive standardized residuals over the five days, while the deal-specific *Max* measure uses only the maximum of all standardized residuals over the same time period. Both measures are sensitive to different types of informed trading. *Max* will pick up "spikes," which are days with exceptionally large abnormal trading and/or returns, and implied volatility, respectively. *Sum*, on the other hand, is more sensitive to "sustained unusual activity" when there are several successive days with abnormal returns and volumes in the pre-event window. In the analysis, we use the *Sum* and *Max* measures to test for the presence of informed trading in stock and options markets ahead of SP announcements. In Figure 3, we report the distribution of the *Sum* and *Max* measures derived from the information on options volume. The distribution is far from normal, and closely resembles a heavy-tailed distribution with a substantial amount of weight in the far right tail.[7]

3.4 Predicting spinoffs

There are often waves in financial markets, in which specific financial strategies gain popularity, such as takeovers (Andrade *et al.*, 2001), leveraged buyouts, or similar corporate activities. Similarly, there are time trends in corporate divestitures, which make it challenging for researchers to differentiate truly informed trading from random speculation. In addition, some investors may have superior forecasting ability, which will allow

[6] Our results are robust to the inclusion of weekly dummies to control for the possibility that option volumes, prices, and bid-ask spreads behave differently in the week before expiration.

[7] A simulation of the *Sum* and *Max* metrics using standard normally distributed random variables confirms that the in-sample *Sum* and *Max* metrics, for our case, have many more observations in the right tail of the distribution, compared to the random, independently and identically distributed normal benchmark.

them to predict an upcoming SP announcement better than other market participants. In such a case, we may naturally expect a higher level of trading activity that could be amplified through herding behavior and momentum trading, without necessarily any direct evidence of informed trading. While some investors may be accurate forecasters of corporate SPs, they may not necessarily be able to forecast the exact time of the announcements. Thus, as we examine *abnormal* trading activity during a short period immediately preceding public announcements, such a possibility would effectively make it more difficult for us to conclude that our results are due to informed trading, as we would measure abnormal activity relative to a higher predicted benchmark of normal activity.

In order to address the above selection and endogeneity concerns, we construct a control sample of firms that would be likely to implement a SP, but that did not effectively sell a subsidiary or division during the sample period. More precisely, we construct a propensity-matched control sample based on a SP prediction model. Roberts and Whited, 2012 explain how the propensity-score matching technique conditions the estimation on the probability of receiving treatment, such as being part of the SP sample, conditional on the observable covariates. This effectively results in randomization, whereby the potential outcomes are assumed to be independent of the assignment into the treatment and control groups, respectively.

To construct the SP prediction model, we use the universe of North American Compustat firms from 1996 to 2013 that have complete quarterly information for the balance sheet items total assets, total liabilities, and market capitalization. We further require all companies to have valid stock price information in CRSP. This results in a total of 18,402 companies with an equivalent of 577,466 firm-quarter observations. We construct the variable $SPIN$, which takes on the value one in a quarter in which the parent spins off a subsidiary, and zero in all other quarters. Using a vector of observable covariates X containing information on firms' balance sheets, corporate governance, industry characteristics, and stock and options trading, we predict SPs with a logistic regression specified as $Prob(SPIN = 1) = 1/(1 + \exp(-\alpha - X\beta))$.

In all our tests, we compare the outcomes of informed trading activity between the treatment and control groups, where the treatment group is based on our sample of SP events, and the control group is constructed based on non-SP firm-quarter observations that have the closest match to the treatment group in terms of their propensity scores. Given our focus

on the abnormal activity in both the stock and options markets, we require both treatment and control observations to have valid stock and options price and volume information, at the time of the announcement, although the predictive logistic regression is estimated over the full sample. As an alternative matching procedure, we also estimate the logistic model over the subsample of company-quarters with available stock and options information (we impose the filter before running the logistic regression), and construct control samples based on the propensity scores. The logistic regression results are not qualitatively different from the benchmark models. We use both the closest and the two closest matches for both the full sample and the restricted options sample, which produces four control groups. We define the treatment group to be $PS0$, and the propensity-matched control groups to be $PS1$ if the control group includes only the first best match, and $PS2$ if it includes the two best matches.

Table A-1 in the Appendix presents the sample characteristics of the treatment group and the propensity-matched control groups. The sample statistics in each group resemble each other closely, and the differences are not statistically significant, except in the case of retained earnings divided by total assets. This evidence confirms that the propensity-matched control samples are closely matched to the treatment group.

4 Evidence of Pre-Announcement Informed Trading

In this section, we first examine informed trading activity in stocks and options in the period preceding SP announcements (Subsection 4.1), and attempt to quantify this activity (Subsection 4.2). We then examine informed trading in call and put options of different degrees of moneyness (Subsection 4.3), and in subsamples split by parent firm characteristics (Subsection 4.4). We also provide an examination of informed trading in the parent firms' stocks and options using intra-day data (Subsection 4.5), and investigate the predictability of CARs using informed trading measures (Subsection 4.6). After we examine informed trading activity in the parent firms' corporate bonds and related CDS contracts (Subsection 4.7), we discuss our results (Subsection 4.8).

4.1 Where do informed investors trade in the equity market?

We report the results for the measures of informed trading in Table 3. All our conclusions are based on the treatment effects. We conclude in favor of informed trading activity if the measures of informed trading are greater in the treatment sample than in the propensity-matched control sample. We find significant evidence of informed trading activity in the options market, but less evidence in the stock market. The option results are robust for both price and volume measures, across the different control samples, and for both the *Sum* and *Max* measures that proxy for informed trading. Comparing abnormal volume or returns relative to a propensity-matched control sample is conceptually akin to a differences-in-differences specification, where we control for both firm characteristics and time.[8]

Panel A.1 of Table 3 reports the results for abnormal stock returns. As the *Sum* and *Max* measures are constructed using standardized residuals, we can interpret them in units of standard deviation. The difference in the *Sum* and *Max* measures between the treatment and control group ranges between 0.09 and 0.38 standard deviations. While we do find significant differences between the treatment and control groups for stock returns, these findings (unreported) are not robust across different types of model specifications. The evidence that parent companies have larger abnormal announcement returns that are significantly higher than those of a propensity-matched control sample is, thus, mixed. More importantly, for the results in Panel A.2, we find no evidence that abnormal stock trading volume in the treatment sample is significantly different from that in the control sample.

In contrast to the results for stocks, we find significant evidence of informed trading activity in options ahead of SP announcements. In Panels A.3 and A.4 of Table 3, we report the results for excess implied volatility and options volume. The findings in both panels support that, in the treatment sample, there is abnormal options volume and excess implied volatility that is significantly greater than in the propensity-matched control sample. The results are consistently significant, mostly at the 1% level,

[8]We formally show in the Internet Appendix Section A that the treatment effects on Max_i and Sum_i (the differences of these measures between the treatment and control groups), converge toward a normal distribution with zero mean under the Lindeberg-Levy Central Limit Theoreom, because the treatment effect has zero mean and finite variance. This allows the use of the Student t-test for statistical inference.

and are not dependent on the sample involved, or the method used for constructing the control group. The average difference in the *Sum* and *Max* measures between the treatment and control groups ranges between 0.16 and 0.66 standard deviations for implied volatility, and between 0.25 and 0.46 standard deviations for options volume.

We find strong evidence of informed trading activity in options, but weaker support for stocks, in the five-day window preceding the SP announcements. This confirms the conjecture discussed in Subsection 3.1. One plausible explanation for the difference could be the limited risk feature of options, rather than just the leverage argument. In the case of SPs, even a well-informed trader would be uncertain about the precise effect on the stock price, specifically as to whether or not it will increase, and if so, by how much. Depending on the determination, a trader would buy call options rather than stocks (but not at a high leverage ratio, i.e., closer to ITM), if (s)he was sure about the magnitude and sign of the increase in the stock price. Unlike the M&A case, where a well-informed trader can pick the option strike and maturity that provides a high leverage, in the SP case, the trader's choice of the option series is more risky. Hence, a risk-averse agent will probably pick one with a high probability of ending up ITM, assuming that (s)he wants to play it safe.

In Panel B of Table 3, we report the results for the call and put options. While the most straightforward way to bet on a rise in the parent's stock price is to buy a plain vanilla call option, an investor could also replicate this strategy by buying the stock and a put. Such a strategy is, however, less likely if the investor is capital constrained. While the results indicate greater unusual activity in both call and put options, the magnitudes of the differences between the treatment and control groups are consistently larger for call options. The average differences in the *Sum* (*Max*) measures between the treatment and control groups range between 0.15 and 0.28 (0.27 and 0.53) standard deviations for call volume, and between 0.06 and 0.24 (0.12 and 0.37) standard deviations for put volume. The differences are significant for call volume, yet often insignificant for put volume. This confirms our prior of greater abnormal volume in call options, due to greater leverage provided by call options for some informed traders, and the downside protection for the more conservative informed traders.[9]

[9]We verified all of our results using delta-adjusted stock volume, as well as the com-

If investors are truly informed, they should be able to differentiate between those events with negative versus positive abnormal announcement returns. Given that the distribution of abnormal announcement returns contains both positive and negative values (see Figure 1), we separately examine pre-announcement abnormal call and put options volume activity in Panels B.3 and B.4 of Table 3, conditioning on the sign of the announcement return. We find that the abnormal options activity in the pre-announcement period is primarily driven by abnormal call options volume for those announcements that are associated with positive abnormal stock returns, as all test statistics in Panel B.3 are consistently significant at either the 1% or 5% significance level.[10] We did not find any significant evidence of pre-announcement abnormal options activity for SP announcements that are associated with negative stock performance, and hence do not report them.

4.2 Quantifying informed trading

After documenting supportive evidence of informed trading in options, we attempt to quantify how many of these SP events are prone to insider trading. In Panel A of Table 4, we report the fraction of the sample, in percentage terms, that exhibits statistically significant abnormal trading volume. Using a more conservative out-of-sample test, we find that approximately 9% of all SP events exhibit unusual trading activity in the pre-announcement period at the 5% statistical significance level.[11] The reported results are based on the most conservative model. Using the same model as in Acharya and Johnson, 2010, we find (in unreported results) that there is abnormal trading activity in approximately 13% of all SP events at the 5% significance level, and in 16% of all events if we use a simple constant mean benchmark model.

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ponent of stock volume that is orthogonal to the contemporaneous options volume (the regression residual of the stock volume on the options volume). These robustness tests separate the influences of options trading from the volume of stock trading. Our conclusion of informed trading in options, but not in stocks, does not change.

[10] In Panel B.4 of Table 3, there is some evidence of abnormal pre-announcement activity in put options, but it is weaker and not robust across tests.

[11] By out-of-sample test, we mean that we calculate abnormal options volume in event days -5 to -1 in excess of the average options volume from event days -63 to -6 (three months). The cumulative abnormal options volume is the sum of the abnormal volumes from days -5 to -1.

To be even more cautious with our interpretation, we report in Panel B of Table 4 the number of treatment firms with abnormal options volume in excess of a randomly matched control group, expressed as a percentage of the total sample, and using both the *Sum* and *Max* measures. At the 5% significance level, we find that about 5% of all SP events appear to be prone to insider trading.

4.3 Leverage vs. liquidity

We also partition the options sample by moneyness to better understand where informed investors trade. A priori, OTM call options provide relatively greater leverage than ATM and ITM call options. However, in addition to choosing between the stock and the options markets to express his/her views, an investor must also trade off greater leverage for lower market liquidity and the uncertainty of the outcome. As deep OTM (DOTM) options are typically less liquid, an unusual size may alert the market maker (and the regulators, if illegal), and, if traded, may be more easily detected. Furthermore, we provide evidence that, although the parent's stock price consistently rises upon the SP announcement, the magnitude of the price increase is not as strong as in the case of targets in a tender offer. Thus, the further OTM the option, the less likely it is that the gain will be pocketed.

We classify call and put options into different moneyness/depth categories. Moneyness is defined as S/K, the ratio of the stock price S to the strike price K. DOTM corresponds to $S/K \in [0, 0.80]$ for calls ($[1.20, \infty)$ for puts), OTM corresponds to $S/K \in (0.80, 0.95]$ for calls ($[1.05, 1.20)$ for puts), ATM is defined by $S/K \in (0.95, 1.05)$ for calls ($(0.95, 1.05)$ for puts), ITM is defined by $S/K \in [1.05, 1.20)$ for calls ($(0.80, 0.95]$ for puts), and DITM corresponds to $S/K \in [1.20, \infty)$ for calls ($[0, 0.80]$ for puts). All results are reported in Panels C and D of Table 3 for call and put options, respectively. Due to insufficient liquidity, we do not report results for DITM calls and DOTM puts.

Consistent with our conjecture, we find that the abnormal call options volume is consistently statistically greater in the treatment group than in the control group only for the OTM and ATM categories, as suggested by the values reported in Panels C.2 and C.3 of Table 3. Irrespective of the specification, the *t*-test results for the difference in means is statistically significant, mostly at the 1% or 5% levels. In contrast, the results are sta-

tistically insignificant for DOTM call options and comparatively weaker for ITM call options, as reported in Panels C.1 and C.4 respectively (in unreported tests, we find that results depend on the nature of the control sample and the model). This confirms our conjecture that informed investors prefer to trade in "out-of but near-the-money" call options. Again, this is in contrast to the M&A case, where there is much more trading in DOTM and OTM options than in ATM and ITM options, due to the greater potential jump in price and the certainty that informed traders would have regarding the outcome (Augustin *et al.*, 2018). We also examine the cross-sectional differences for put options. In Panel D of Table 3, there is no evidence of unusual activity in either ATM or ITM options. Also, in Panel D.4, we do not observe statistically significant differences between the treatment and control groups for the DITM put option category. Surprisingly, in Panel D.1, we find significant differences across treatment and control groups for OTM put options. These results could be due to the uncertainty of the outcome (the possibility that the stock price will decline after the announcement). An informed trader, therefore, would prefer a low-risk strategy and sell OTM rather than ITM puts, which carry a higher exercise risk that is at the discretion of the counterparty.

4.4 Informed trading and deal characteristics

The earlier studies highlighted cross-sectional differences in SP CARs associated with deal characteristics. Even though we do not find significant cross-sectional differences in our sample, insiders could base their actions on the results from previous studies, which consistently reported higher CARs associated with cross-industry SPs or larger SPs. Accordingly, we verify whether there is evidence of greater unusual options activity within subsamples that we split along different dimensions of deal characteristics.

In Table 5, we report the treatment effects for the measures of abnormal options volume, as well as the differences between the treatment effects in the subgroups, conditioning on deal characteristics. We find statistically significant and greater measures of unusual options trading activity in the samples of completed deals (Panel A), diversified SPs (Panel B), larger deals (Panel C), and deals that are ex ante considered to have a lower conglomerate discount (Panel E). On the other hand, the informed trading measures are statistically insignificant, and of a much smaller magnitude, in the samples of withdrawn deals (Panel A), focused SPs (Panel

B), smaller deals (Panel C), and deals that are ex ante considered to have a high conglomerate discount (Panel E). Only the results in Panel D of Table 5, which exhibit greater magnitudes for the *Sum* and *Max* measures are, to some extent, inconsistent with the findings of greater CARs for divested companies that are incorporated at a lesser distance from the parent's headquarters. However, the differences across groups are not statistically significant, based on the results in columns (5) and (6).

4.5 Order-flow imbalances and high-frequency trading data

The previous evidence of unusual activity in the options market, but not in the stock market, is based on daily price and unsigned volume information. To ensure that the abnormal activity is in the direction of advance information about the forthcoming events, we also examine order flows in stocks and options ahead of SP announcements using more high-frequency trading data.[12] While this has the benefit of providing more targeted evidence of unusual trading activity, we unfortunately have this information only for a shorter time period and, therefore, have a more restricted sample size (94 SPs) after merging the sample with options tick data from OPRA for the 2005 to 2013 period.

We follow Hu, 2014 and construct a measure for options order imbalance (*OOI*) and a measure of stock order imbalance (*SOI*). We assume that options market makers consistently delta hedge their stock exposures fully, and that customers actively seek delta exposure (they do not hedge). Intuitively speaking, our measure of option order flow imbalance reflects the net difference between customer buy and sell delta-adjusted option volumes. More formally, for each stock i on day t, we construct *OOI* as:

$$OOI_{i,t} = \frac{\sum_{j=1}^{n} 100 Dir_{i,t,j} \cdot \delta_{i,t,j} \cdot size_{i,t,j}}{Num\_shares\_outstanding_i}, \tag{1}$$

where $Dir_{i,t,j}$ is an indicator variable equal to one (minus one), if the jth option trade is a buyer-initiated (seller-initiated) trade. The direction of

[12] As a robustness check, in unreported tests, we also examined abnormal order imbalances in the options market using the signed options volume data available from the International Securities Exchange (ISE). These results indicate that, in the period preceding SP announcements, firms open more long call and short put positions compared to a normal benchmark period.

the trade is based on the Lee and Ready, 1991 algorithm without applying any delay for quotes. The option's delta $\delta_{i,t,j}$ denotes the sensitivity of the option price to a change in the underlying stock price, and $size_{i,t,j}$ denotes the number of contracts for each trade. We scale the numerator by the total number of shares outstanding, and we multiply it by 100, given that each option contract is for a lot of 100 shares.

In order to obtain a measure of net *SOI* that is independent of *OOI*, we subtract *OOI* from the total order imbalance (*TOI*) in the stock market. Formally, we calculate:

$$SOI_{i,t} = TOI_{i,t} - OOI_{i,t} = \frac{\sum_{j=1}^{n} Dir_{i,t,j} \cdot size_{i,t,j}}{Num\_shares\_outstanding_i} - OOI_{i,t}, \quad (2)$$

where $Dir_{i,t,j}$ and $size_{i,t,j}$ refer to the direction and size of the jth stock trade.[13] Thus, *SOI* is the stock order imbalance that is caused purely by stock market investors, and not the result of possible hedging demand due to order imbalance in the options market. Intuitively, *SOI* measures the net difference between buyer- and seller-initiated stock volumes, scaled by the number of shares outstanding.

In Table 6, we report the statistics on the measures of informed trading, calculated using abnormal *SOI* and *OOI*, for the differences between the treatment and control groups. The results are largely consistent with our previous evidence of greater unusual activity in the options market than in the stock market. Unconditionally, the differences in abnormal volumes between the treatment and control groups are smaller for the order-flow imbalance in the stock market than in the options market. The values for *Sum* (*Max*) range between 0.06 and 0.13 (0.07 and 0.21) standard deviations for *SOI*, and between 0.22 and 0.32 (0.25 and 0.38) standard deviations for *OOI* (note that abnormal *OOI* is delta-adjusted). However, the *SOI* in the treatment group is not always statistically different from that in the propensity-matched control group based on observable firm characteristics. In unreported results, we also find that the difference in abnormal *OOI* between the treatment and control groups is consistently

[13] We apply a five-second delay in quote prices until 1998, and no delay afterward when assigning trade directions, because the recording lag is not observed in the recent sample period as noted by Madhavan *et al.*, 2005 and Chordia *et al.*, 2005. See also Lee and Ready, 1991 on this matter.

statistically significant at conventional significance levels across different benchmark models and controls groups. The intra-day evidence suggests that the options market exhibits unusual buying activity in the period preceding the SP announcements, while there is less evidence for such activity in the stock market.

4.6 Does informed trading predict abnormal announcement returns?

If there exists informed trading in the options market, we should observe a relation between the measures of informed trading extracted from the options market and the SP CARs. To test this conjecture, we regress the announcement day CARs on the *Sum* and *Max* measures computed from the options and stock markets.

The results in columns (1) and (5) of Table 7 suggest that only abnormal options volume positively predicts CARs with a coefficient that is statistically significant at the 5% level. The economic magnitude is also substantial, as the coefficient of 0.02 implies that a one standard deviation increase in the *Max* measure for options volume is associated with a 2% greater CAR. All other measures are statistically insignificant. The explanatory power of the regression is a modest 2% and 3% in columns (1) and (5) respectively. In columns (2) and (6), we add *OOI* to the regression, which raises the R^2 to 3% and 5% respectively, while not introducing any major change to the coefficient on options volume. This suggests that the *OOI*, a measure of net buying activity, may contain additional information for SP CARs beyond what is captured by abnormal options volume, although this could potentially also arise because of a smaller sample. In columns (3)-(4) and (7)-(8), we replicate the previous results and add several control variables related to the corporate governance, as well as firm and industry characteristics. Importantly, none of the measures reduces the statistical significance of the coefficient for options volume, nor do they fundamentally change the economic magnitude. Overall, these results suggest that abnormal options volume in the pre-announcement period contains information on the CARs of the parent company.

4.7 Informed trading in the CDS and corporate bond markets

In this subsection, we examine informed trading ahead of the corporate divestiture announcements in both the cash and derivative fixed income

markets. Thus, we investigate the preferred venue of informed traders *across* asset classes. Adopting the same approach as for the equity market analysis, we examine measures of informed trading, *Sum* and *Max*, as well as their differences, in our treatment and propensity-matched control samples. We examine different benchmark models, but irrespective of which test statistic we consider, the difference between the treatment and control groups is not statistically significant. Hence, we do not report them. There appears to be no significant abnormal activity in either the bond or CDS market before the SP announcement.[14]

4.8 The "pecking order of informed trading"

We find no evidence of pre-announcement informed trading activity in the cash or derivatives fixed income market. Despite our limited sample size of 49 events with registered corporate bond transactions ahead of corporate divestiture announcements, the absence of abnormal pre-announcement activity may reflect the illiquidity of these markets, especially as TRACE captures more than 99% of all the secondary market trading activity for U.S. corporate bonds.

Our conclusion that options are the preferred avenue for informed traders may perhaps be rationalized by considering the objectives and constraints of an informed investor. An informed investor would like to maximize their leverage by taking into account a market's illiquidity and the associated risk of regulatory detection. For one thing, an informed investor anticipating a decrease in bond prices would need to short-sell the bond in order to implement a bearish trade. Shorting bonds can be prohibitively costly, especially if bonds are "special" (Nashikkar and Pedersen, 2007; Nashikkar *et al.*, 2011), which can sometimes prevent the elimination of arbitrage opportunities (Blanco *et al.*, 2005). Although leverage may be obtained in the CDS market, it involves substantially larger transaction costs than in the options market. In addition, given the smaller price increase in the parent's stock price compared to that in a target's stock price upon the announcement of an M&A, the leverage argument has greater importance. Hence, in the case of SP announcements, a "pure" option strategy may dominate a "mixed" strategy, as is theoretically suggested by

[14] We also considered examining trading activity, but for the fixed income market, the limited sample size makes it impossible to study volumes (there is relatively little volume in bonds), as well as to examine trading volume in CDSs.

Easley *et al.*, 1998, and by John *et al.*, 2003 in the case of M&A announcements. Even though the stock market is the most liquid market, it may not be able to "compete" with the options market on a "leverage-adjusted transaction cost" basis.

We present summary statistics for comparable transaction cost measures in all four markets in Table 8 (stocks, options, bonds, and CDSs). The corporate bond market is the most illiquid, with an average transaction cost of 185 bps (Friewald *et al.*, 2012).[15] Comparing this bid-ask spread with an effective yield spread of 2.87%, the average bid-ask spread as a percentage of the average spread is equal to 64%. For the CDS market, we estimate the average CDS bid-ask spread to be 34 bps, after averaging across rating groups and portfolio groups as provided by Bongaerts *et al.*, 2011.[16] Comparing this with an average five-year CDS spread level of 327 bps (Lando and Mortensen, 2005) yields a 10% relative bid-ask spread.[17]

For equity options, Muravyev and Pearson, 2014 report an effective bid-ask spread of 8.4 cents per share on average. Comparing this bid-ask spread with their average option price of $1.70 implies a relative bid-ask spread of 5%.[18] These values are consistent with Goyenko *et al.*, 2014, who report relative bid-ask spreads in the equity options market ranging from 3.2% for ITM calls to 7.9% for OTM calls. In comparison, the average effective spread in the stock market is 8 bps, representing an average relative effective spread of 1.54%.

These rough estimates arguably change across time periods and across samples. Yet, they suggest a ranking of the magnitudes of transaction costs. Thus, our findings of informed trading activity in the options mar-

[15]Friewald *et al.*, 2012 approximate the round-trip cost using Roll's effective measure of bid-ask spreads (Roll, 1984). Their estimates range from 24 bps at the 5th percentile of the distribution to 421 bps at the 95th percentile of the distribution. The standard deviation is 145 bps.

[16]Bongaerts *et al.*, 2011 provide, in their Table II, estimates of corporate CDS bid-ask spreads for portfolios sorted on the size of transaction costs and credit risk. The expected transaction costs range from 12 basis point for Aaa to Aa rated companies in the low transaction cost group, to 1,120 bps for the B to Caa rated companies in the high transaction costs group.

[17]Lando and Mortensen, 2005 report average CDS spreads across rating categories ranging from 26 bps for Aaa ratings to 1,349 bps for Caa-C ratings. The value of 327 bps is a simple average, based on our calculations.

[18]This estimate is likely too high, given that the authors propose a correction of the effective bid-ask spread that implies lower transaction costs. In addition, they show that transaction costs in the options market have declined over time.

ket ahead of corporate SP announcements could perhaps be rationalized by the tradeoff between leverage and liquidity. This would imply a "pecking order of informed trading," where the options market emerges as the preferred venue for informed traders.

5 Conclusion

There is widespread anecdotal and academic evidence of informed trading in financial markets, in particular ahead of M&A announcements. SPs share many characteristics with M&As, which makes them likely to be susceptible to insider trading. SPs are unexpected corporate announcements that precede positive abnormal announcement returns for the parent companies' stock, and occasionally negative abnormal announcement returns for their bonds. As the nature of information is clearly identified, these capital structure announcement effects associated with corporate divestitures provide a unique setting to jointly test for the presence of informed trading across multiple securities traded on the same firm.

Despite little academic and virtually no regulatory evidence on informed trading ahead of corporate divestitures, we find significant evidence of informed trading in options, but not in stocks, bonds or CDSs, during the five-day window preceding SP announcements. Our estimates suggest that about 9% to 16% of all events in our sample exhibit abnormal options activity in the pre-announcement period. This evidence is apparent in measures of abnormal options volume and excess implied volatility, which are either unusually large or persistently abnormal. By comparing abnormal activity in the treatment group with a propensity-matched control group, we effectively apply a differences-in-differences test and address sample selection and endogeneity concerns. More granular tests show that the unusual activity in options is greater for call options than for put options, and that it arises primarily in OTM and ATM call options. This evidence is confirmed using tick-by-tick data for both stocks and options markets. Abnormal options volume in the pre-announcement period positively predicts abnormal announcement returns. In contrast, we find no evidence of unusual trading activity ahead of the announcements in the fixed income market.

Our work emphasizes the economically distinct nature of SPs and their suitability for studies of informed trading across multiple markets. In addi-

tion, we provide the first examination of the presence of abnormal trading activity ahead of announcements of corporate SPs in the U.S., in both the equity (stock and equity options) and the fixed income (bonds and CDSs) markets. We believe that this analysis is important due to the significant presence of SP deal activity.

References

Acharya, V. V. and T. C. Johnson. 2010. "More Insiders, More Insider Trading: Evidence from Private-Equity Buyouts". *Journal of Financial Economics*. 98(3): 500–523.

Ahn, S. and D. J. Denis. 2004. "Internal capital markets and investment policy: evidence from corporate spinoffs". *Journal of Financial Economics*. 71(3): 489–516.

Allen, J. W., S. L. Lummer, J. J. McConnell, and D. K. Reed. 1995. "Can Takeover Losses Explain Spin-Off Gains?" *The Journal of Financial and Quantitative Analysis*. 30(4): 465–485.

Andrade, G., M. Mitchell, and E. Stafford. 2001. "New Evidence and Perspectives on Mergers". *The Journal of Economic Perspectives*. 15(2): 103–120.

Augustin, P., M. Brenner, and M. G. Subrahmanyam. 2018. "Informed options trading ahead of takeover announcements: Insider trading?" *Management Science*. Forthcoming.

Augustin, P., M. G. Subrahmanyam, D. Y. Tang, and S. Q. Wang. 2014. "Credit Default Swaps: A Survey". *Foundations and Trends in Finance*. 9(1–2): 1–196.

Bebchuk, L., A. Cohen, and A. Ferrell. 2009. "What Matters in Corporate Governance?" *Review of Financial Studies*. 22(2): 783–827.

Berger, P. G. and E. Ofek. 1995. "Diversification's effect on firm value". *Journal of Financial Economics*. 37(1): 39–65.

Bhattacharya, U. 2014. "Insider Trading Controversies: A Literature Review". *Annual Review of Financial Economics*. 6(1): 385–403.

Billings, M. B. and R. H. Jennings. 2011. "The option market's anticipation of information content in earnings announcements". *Review of Accounting Studies*. 16(3): 587–619.

Blanco, R., S. Brennan, and I. W. Marsh. 2005. "An empirical analysis of the dynamic relation between investment-grade bonds and credit default swaps". *Journal of Finance*. 60(5): 2255–2281.

Bongaerts, D., F. De Jong, and J. Driessen J. 2011. "Derivative pricing with liquidity risk: Theory and evidence from the credit default swap market". *Journal of Finance*. 66(1): 203–240.

Burch, T. R. and V. Nanda. 2003. "Divisional diversity and the conglomerate discount: evidence from spinoffs". *Journal of Financial Economics*. 70(1): 69–98.

Cao, C., Z. Chen, and J. M. Griffin. 2005. "Informational Content of Option Volume Prior to Takeovers". *The Journal of Business*. 78(3): 1073–1109.

Cao, H. H. and H. Ou-Yang. 2009. "Differences of Opinion of Public Information and Speculative Trading in Stocks and Options". *Review of Financial Studies*. 22(1): 299–335.

Carhart, M. M. 1997. "On persistence in mutual fund performance". *The Journal of Finance*. 52(1): 57–82.

Chan, K., L. Ge, and T.-C. Lin. 2015. "Informational Content of Option Trading on Acquirer Announcement Return". *Journal of Financial and Quantitative Analysis*. 50(5): 1057–1082.

Chordia, T., R. Roll, and A. Subrahmanyam. 2005. "Evidence on the speed of convergence to market efficiency". *Journal of Financial Economics*. 76(2): 271–292.

Copeland, T. E., L. E. F., and D. Mayers. 1987. "Corporate spinoffs: multiple announcement and ex-date abnormal performance". *Copeland, T.E. (ed.), Modern Finance and Industrial Economics: Papers in Honor of J. Fred Weston. Oxford: Basil Blackwell*: 114–137.

Coval, J. D. and T. J. Moskowitz. 1999. "Home Bias at Home: Local Equity Preference in Domestic Portfolios". *The Journal of Finance*. 54(6): 2045–2073.

Coval, J. D. and T. J. Moskowitz. 2001. "The Geography of Investment: Informed Trading and Asset Prices". *Journal of Political Economy*. 109(4): 811–841.

Custodio, C. 2014. "Mergers and Acquisitions Accounting and the Diversification Discount". *The Journal of Finance*. 69(1): 219–240.

Daley, L., V. Mehrotra, and R. Sivakumar. 1997. "Corporate focus and value creation evidence from spinoffs". *Journal of Financial Economics*. 45(2): 257–281.

Dasilas, A., S. Leventis, M. Sismanidou, and K. Koulikidou. 2011. "Wealth Effects and Operating Performance of Spin-Offs: International Evidence". *Working Paper*.

Duffie, D. 1999. "Credit Swap Valuation". *Financial Analysts Journal*. 55(1): 73–87.

Easley, D., M. O'Hara, and P. S. Srinivas. 1998. "Option Volume and Stock Prices: Evidence on where Informed Traders Trade". *The Journal of Finance*. 53(2): 431–465.

Fama, E. F. and K. R. French. 1993. "Common risk factors in the returns on stocks and bonds". *Journal of Financial Economics*. 33(1): 3–56.

Foster, G., C. Olsen, and T. Shevlin. 1984. "Earnings Releases, Anomalies, and the Behavior of Security Returns". *The Accounting Review*. 59(4): 574–603.

Friewald, N., R. Jankowitsch, and M. G. Subrahmanyam. 2012. "Illiquidity or credit deterioration: A study of liquidity in the US corporate bond market during financial crises". *Journal of Financial Economics*. 105(1): 18–36.

Ge, L., J. Hu, M. Humphery-Jenner, and T.-C. Lin. 2016. "Informed Options Trading Prior to Bankruptcy Filings". *Working Paper*.

Gertner, R., E. Powers, and D. Scharfstein. 2002. "Learning about Internal Capital Markets from Corporate Spin-offs". *Journal of Finance*. 57(6): 2479–2506.

Gharghori, P., E. D. Maberly, and A. Nguyen. 2017. "Informed Trading Around Stock Split Announcements: Evidence from the Option Market". *Journal of Financial and Quantitative Analysis*. 52(2): 705–735.

Giroud, X. 2013. "Proximity and Investment: Evidence from Plant-Level Data". *The Quarterly Journal of Economics*. 128(2): 861–915.

Goyenko, R., C. Ornthanalai, and S. Tang. 2014. "Trading cost dynamics of market making in equity options". *Working Paper*.

Habib, M. A., D. Johnsen, and N. Y. Naik. 1997. "Spinoffs and Information". *Journal of Financial Intermediation*. 6(2): 153–176.

Hao, Q. 2016. "Is there information leakage prior to share repurchase announcements? Evidence from daily options trading". *Journal of Financial Markets*. 27(1): 79–101.

Hayunga, D. K. and P. P. Lung. 2014. "Trading in the Options Market around Financial Analysts' Consensus Revision". *Journal of Financial and*. 49(3): 725–747.

Hilscher, J., J. M. Pollet, and M. Wilson. 2015. "Are Credit Default Swaps a Sideshow? Evidence That Information Flows from Equity to CDS Markets". *Journal of Financial and Quantitative Analysis*. 50(3): 543–567.

Hite, G. L. and J. E. Owers. 1983. "Security price reactions around corporate spin-off announcements". *Journal of Financial Economics*. 12(4): 409–436.

Hoechle, D., M. Schmid, I. Walter, and D. Yermack. 2012. "How much of the diversification discount can be explained by poor corporate governance?" *Journal of Financial Economics*. 103(1): 41–60.

Hu, J. 2014. "Does option trading convey stock price information?" *Journal of Financial Economics*. 111(3): 625–645.

Jin, W., J. Livnat, and Y. Zhang. 2012. "Option Prices Leading Equity Prices: Do Option Traders Have an Information Advantage?" *Journal of Accounting Research*. 50(2): 401–432.

John, K., A. Koticha, R. Narayanan, and M. G. Subrahmanyam. 2003. "Margin Rules, Informed Trading in Derivatives and Price Dynamics". *Working Paper New York University, Stern School of Business*.

John, K. and E. Ofek. 1995. "Asset sales and increase in focus". *Journal of Financial Economics*. 37: 105–126.

Johnson, T. L. and E. C. So. 2012. "The option to stock volume ratio and future returns". *Journal of Financial Economics*. 106(2): 262–286.

Kadan, O., R. Michaely, and P. C. Moulton. 2018. "Trading in the presence of Asymmetric Information: Evidence from Analyst Recommendation Changes". *Journal of Financial and Quantitative Analysis*. Forthcoming.

Kaniel, R., S. Liu, G. Saar, and S. Titman. 2012. "Individual Investor Trading and Return Patterns around Earnings Announcements". *The Journal of Finance*. 67(2): 639–680.

Kedia, S. and X. Zhou. 2014. "Informed trading around acquisitions: Evidence from corporate bonds". *Journal of Financial Markets*. 18: 182–205.

Klein, A. 1986. "The Timing and Substance of Divestiture Announcements: Individual, Simultaneous and Cumulative Effects". *The Journal of Finance*. 41(3): 685–696.

Kothari, S. P. and J. B. Warner. 2007. "Econometrics of Event Studies". *Handbook of Corporate Finance: Empirical Corporate Finance*. 1(Chapter 1): 3–36. Ed. by B. E. Eckbo.

Krishnaswami, S. and V. Subramaniam. 1999. "Information asymmetry, valuation, and the corporate spin-off decision". *Journal of Financial Economics*. 53(1): 73–112.

Laeven, L. and R. Levine. 2007. "Is there a diversification discount in financial conglomerates?" *Journal of Financial Economics*. 85(2): 331–367.

Lamont, O. A. and C. Polk. 2002. "Does diversification destroy value? Evidence from the industry shocks". *Journal of Financial Economics*. 63(1): 51–77.

Lando, D. and A. Mortensen. 2005. "Revisiting the slope of the credit spread curve". *Journal of Investment Management*. 3(4): 1–27.

Lee, C. M. C. and M. J. Ready. 1991. "Inferring trade direction from intraday data". *The Journal of Finance*. 46(2): 733–746.

Lee, J., A. Naranjo, and S. Sirmans. 2016. "The Exodus from Sovereign Risk: Sovereign Ceiling Violations in Credit Default Swap Markets". *The Journal of Finance*. 74(4): 1813–1856.

Lerner, J. 1995. "Venture Capitalists and the Oversight of Private Firms". *The Journal of Finance*. 50(1): 301–318.

Lowry, M., M. Rossi, and Z. Zhu. 2018. "Informed Trading by Adviser Banks? Evidence from Options Holdings". *Review of Financial Studies*. Forthcoming.

Madhavan, A., D. Porter, and D. Weaver. 2005. "Should securities markets be transparent?" *Journal of Financial Markets*. 8: 266–288.

Martin, J. D. and A. Sayrak. 2003. "Corporate diversification and shareholder value: a survey of recent literature". *Journal of Corporate Finance*. 9(1): 37–57.

Maxwell, W. F. and R. P. Rao. 2003. "Do Spin-offs Expropriate Wealth from Bondholders?" *The Journal of Finance*. 58(5): 2087–2108.

Mian, A. 2006. "Distance Constraints: The Limits of Foreign Lending in Poor Economies". *The Journal of Finance*. 61(3): 1465–1505.

Miles, J. A. and J. D. Rosenfeld. 1983. "The Effect of Voluntary Spin-off Announcements on Shareholder Wealth". *The Journal of Finance*. 38(5): 1597–1606.

Muravyev, D. and N. D. Pearson. 2014. "Option Trading Costs Are Lower Than You Think". *Working Paper*.

Nashikkar, A. and L. H. Pedersen. 2007. "Corporate bond specialness". *New York University Working Paper*.

Nashikkar, A., M. G. Subrahmanyam, and S. Mahanti. 2011. "Liquidity and Arbitrage in the Market for Credit Risk". *Journal of Financial and Quantitative Analysis*. 46(3): 627–656.

Parrino, R. 1997. "Spinoffs and Wealth Transfers: The Marriott Case". *Journal of Financial Economics*. 43(2): 241–274.

Patell, J. M. and M. A. Wolfson. 1979. "Anticipated Information Releases Reflected in Call Option Prices". *Journal of Accounting and Economics*. 1(2): 117–140.

Patell, J. M. and M. A. Wolfson. 1981. "The Ex Ante and Ex Post Price Effects of Quarterly Earnings Announcements Reflected in Option and Stock Prices". *Journal of Accounting Research*. 19(2): 434–458.

Petersen, M. A. and R. G. Rajan. 1994. "The Benefits of Lending Relationships: Evidence from Small Business Data". *The Journal of Finance*. 49(1): 3–37.

Poteshman, A. M. 2006. "Unusual Option Market Activity and the Terrorist Attacks of September 11, 2001". *The Journal of Business*. 79(4): 1703–1726.

Roberts, M. R. and T. M. Whited. 2012. "Endogeneity in Empirical Corporate Finance". *Simon School Working Paper No. FR 11-29*.

Roll, R. 1984. "A simple implicit measure of the effective bid–ask spread in an efficient market". *The Journal of Finance*. 39: 1127–1139.

Royston, J. P. 1982. "Expected Normal Order Statistics (Exact and Approximate)". *Journal of the Royal Statistical Society, Series C (Applied Statistics)*. 31(2): 161–165.

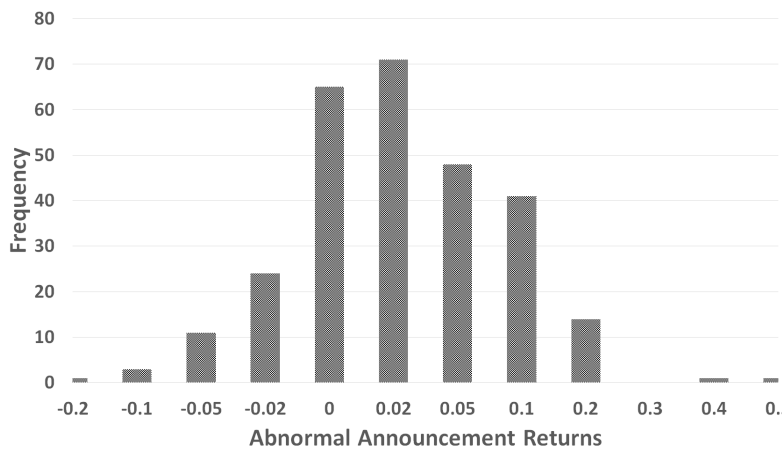
Schipper, K. and A. Smith. 1983. "Effects of recontracting on shareholder wealth: The case of voluntary spin-offs". *Journal of Financial Economics*. 12(4): 437–467.

Sufi, A. 2007. "Information Asymmetry and Financing Arrangements: Evidence from Syndicated Loans". *The Journal of Finance*. 62(2): 629–668.

Veld, C. and Y. V. Veld-Merkoulova. 2008. "An Empirical Analysis of the Stockholder-Bondholder Conflict in Corporate Spin-Offs". *Financial Management*. 37(1): 103–124.

Veld, C. and Y. V. Veld-Merkoulova. 2009. "Value creation through spin-offs: A review of the empirical evidence". *International Journal of Management Reviews*. 11(4): 407–420.

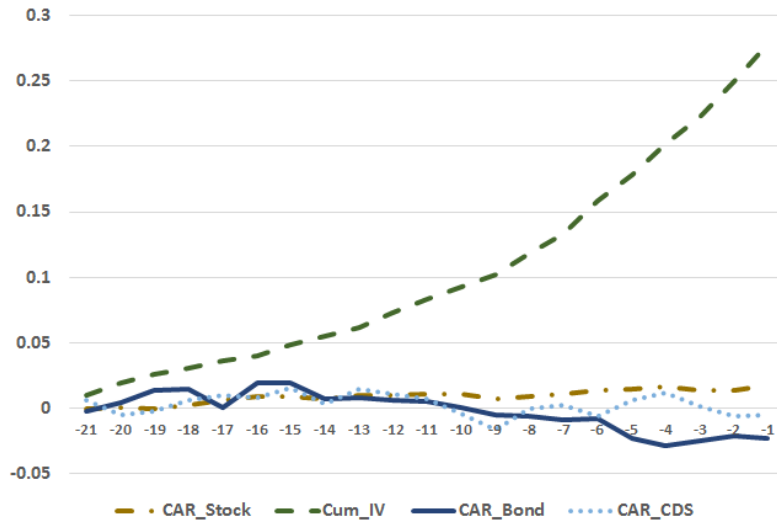
Figure 1: Distribution of Abnormal Announcement Returns.



Description: In this figure, we depict the distribution of FF3F abnormal announcement day returns for the sample of 280 unique spinoff events.

Interpretation: The average FF3F abnormal announcement day return is 1.62%. Most of the abnormal announcement day returns are positive, and the distribution is right-skewed.

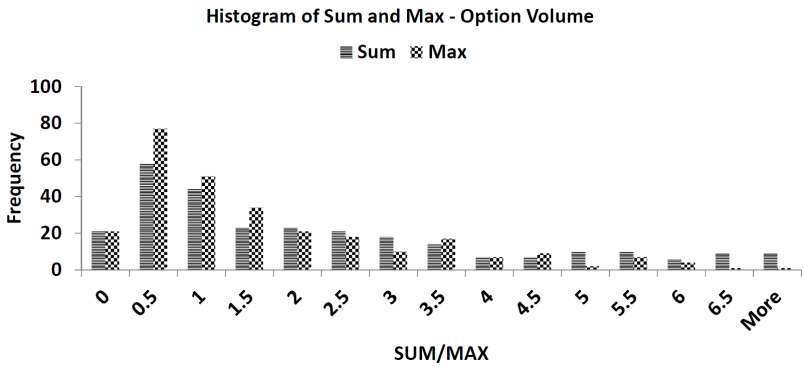
Figure 2: Preliminary Evidence of Pre-Announcement Informed Trading Activity.



Description: In this figure, we depict the pre-announcement informed trading activity in stocks, options, bonds, and CDS. For stocks, bonds, and CDS, we compute CARs based on the FF3F benchmark model estimated over the window $t \in [-252, -21]$. For excess implied volatility, we use a simple market model based on the VIX index as the benchmark.

Interpretation: There are no patterns of abnormal pre-announcement activity in stocks, bonds, or CDSs. There is evidence of abnormal pre-announcement activity options based on the run-up in options-implied volatility.

Figure 3: Distribution of Informed Trading Measures - *Max* and *Sum*.



Description: In this figure, we illustrate the distribution of the *Sum* and *Max* measures for options volume. Sum (Max) is measured as the sum (maximum) of all positive standardized abnormal returns over the five pre-event days, where the normal returns are calculated over the three-month pre-announcement window based on the benchmark model that includes a constant, day-of-week dummies, lagged returns and volume, contemporaneous returns and volume of the market index, lagged values of the dependent and all independent variables, and the VIX price index. The residuals are then standardized and the *Sum* measure is computed as the sum of all positive standardized residuals in the five-day pre-event window.

Interpretation: The distribution of the Sum and Max measures derived from the information on options volume resembles a heavy-tailed distribution with a substantial amount of weight in the far right tail.

Table 1: Summary Statistics of Corporate Spinoffs.

Year	SP	SP w. Val.	Mean	Std.Dev.	Min	Max	SIC2	SIC4	Interstate	Unique SP
1996	24	14	855	756	53	3,108	13	9	14	23
1997	28	18	2,500	6,131	48	26,625	15	6	14	25
1998	30	19	524	746	3	3,078	15	11	10	27
1999	28	18	6,984	15,924	59	62,156	10	3	10	28
2000	36	19	2,978	4,643	24	18,816	15	4	12	33
2001	15	11	3,242	4,261	24	12,213	8	4	6	15
2002	15	10	268	304	41	1,068	8	3	3	15
2003	10	8	2,236	2,721	42	6,809	3	0	4	9
2004	4	2	657	339	417	897	1	0	1	4
2005	10	5	3,161	3,462	225	8,761	3	2	3	10
2006	9	8	5,839	6,724	1,026	17,963	5	4	4	9
2007	18	15	11,845	29,446	70	107,650	8	5	11	15
2008	18	11	4,950	10,239	4	34,569	7	5	7	18
2009	8	5	667	1,115	144	2,661	4	2	1	8
2010	9	4	2,289	2,089	462	5,132	7	4	3	9
2011	20	10	13,934	17,012	1,174	55,513	9	7	11	19
2012	8	5	1,483	1,535	287	4,056	3	2	4	8
2013	5	4	989	837	122	1,753	2	0	3	5
Total	295	186	4,111	11,541	3	107,650	136	71	121	280

Description: In this table, we summarize all corporate SP announcements in the Thomson Reuters SDC Platinum database with a U.S. public parent company for which we could identify matching stock prices (from CRSP), balance sheet information (from Compustat) and both options and tick-by-tick price and volume information for stocks (from OptionMetrics and TAQ), from January 1996 through December 2013. The column *SP* indicates the number of announcements per calendar year, while the column *SP w.Val.* indicates the subsample for which there exists information on the transaction value in SDC Platinum. For this subsample, we report the mean, standard deviation, minimum, and maximum of the SP transaction value (in millions of USD). We also report the number of deals in the same industry, based on the two-digit (*SIC2*) and 4-digit (*SIC4*) SIC codes, the number of divestitures with a parent incorporated in a different state (*Interstate*), and the number of unique SP announcement days.

Interpretation: The main analysis is based on 295 SPs announced on 280 unique event days. The size of the average divestiture is approximately $4.1 billion, with a standard deviation of $11.5 billion. There are 136 (121) deals whose divested subsidiary is in the same SIC2 industry (different sate) than the parent company's headquarters.

Table 2: Spinoff Average Cumulative Abnormal Announcement Returns.

	(1)	(2)	(3)	(4)	(5)	(6)
Event Window	τ=0	[-1,0]	[-1,1]	[-1,3]	[-1,5]	[-1,10]
Panel A: Average Stock CARs ($N = 280$)						
Market Model	1.74%	1.72%	2.53%	2.05%	1.35%	1.40%
(t-stat)	(3.85)	(3.94)	(4.17)	(3.27)	(1.98)	(1.80)
FF3F	1.62%	1.63%	2.38%	1.68%	0.78%	1.21%
(t-stat)	(4.16)	(3.73)	(4.07)	(2.73)	(1.44)	(1.66)
Panel B: Average Bond CARs - TRACE ($N = 49$)						
FF3F	-0.08%	0.27%	0.16%	-0.01%	0.05%	-0.17%
(t-stat)	(-0.40)	(0.75)	(0.38)	(-0.03)	(0.09)	(-0.19)
Panel C: Average Bond CARs - Datastream ($N = 37$)						
FF3F	-0.03%	0.08%	0.24%	0.36%	-0.37%	-0.33%
(t-stat)	(-0.08)	(0.41)	(0.83)	(1.01)	(-0.97)	(-0.75)
Panel D: Average Bond CARs - Bloomberg ($N = 52$)						
FF3F	-0.07%	-0.05%	-0.18%	-0.73%	-0.83%	-1.18%
(t-stat)	(-0.41)	(-0.33)	(-1.00)	(-0.59)	(-0.79)	(-0.97)
Panel E: Average CDS CARs - Simple Return ($N = 54$)						
FF3F	6.23%	5.84%	5.64%	4.54%	5.35%	6.01%
(t-stat)	(2.15)	(1.97)	(1.79)	(1.61)	(1.57)	(1.77)
Panel F: Average CDS CARs - Clean Price Return ($N = 54$)						
FF3F	4.79%	4.35%	4.61%	3.95%	4.87%	4.59%
(t-stat)	(2.07)	(1.85)	(1.73)	(1.49)	(1.91)	(1.86)

Description: In this table, we present SP announcements average cumulative abnormal returns ($\overline{CARs}$) for six different event windows $[\tau_1, \tau_2]$. The number of observations in each panel is denoted by N. The two different expected return models are the market model ($Market\ Model$) and the Fama-French Three-Factor model ($FF3F$). The associated t-statistics, presented in brackets, are adjusted for both cross-sectional and time-series correlation. The estimation window ($[T_1, T_2]$) runs from -252 to -21 calendar days relative to the announcement day that is defined as day $\tau = 0$. Panel A presents $\overline{CARs}$ for the entire sample. In Panels B (C, D), we present $\overline{CARs}$ for bonds using the TRACE (Datastream, Bloomberg) database. In Panels E (F), we present $\overline{CARs}$ for CDS based on simple CDS returns ("clean" price CDS returns) using the Markit database.

Interpretation: There is evidence of positive economic gains earned by the shareholders of parent companies upon the announcement of a corporate divestiture due to positive and statistically significant $\overline{CAR}$s for stocks. There is mixed evidence of $\overline{CAR}$s in fixed income markets, as $\overline{CAR}$s for bonds (CDSs) are insignificant (positive and significant).

Table 3: Empirical Evidence of Informed Trading.

	Treat-Control		Treat-Control		Treat-Control		Treat-Control	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Max	Sum	Max	Sum	Max	Sum	Max	Sum
Panel A	**(A.1) Stock Return**		**(A.2) Stock Volume**		**(A.3) Implied Volatility**		**(A.4) Options Volume**	
PS1-All	0.09	0.20	0.00	-0.02	0.23	0.66	0.27	0.46
(*t*-stat)	(1.37)	(1.76)	(0.03)	(-0.17)	(2.59)	(3.05)	(2.09)	(2.82)
PS2-All	0.12	0.25	-0.05	-0.06	0.19	0.56	0.27	0.44
(*t*-stat)	(1.99)	(2.48)	(-0.52)	(-0.44)	(2.45)	(2.84)	(2.45)	(3.00)
PS1-Options	0.25	0.38	0.09	0.04	0.22	0.55	0.28	0.43
(*t*-stat)	(3.65)	(3.35)	(0.92)	(0.26)	(2.57)	(2.56)	(2.37)	(2.56)
PS2-Options	0.18	0.32	0.02	0.00	0.16	0.47	0.25	0.38
(*t*-stat)	(3.08)	(3.18)	(0.25)	(0.03)	(2.16)	(2.58)	(2.44)	(2.68)
Panel B	**(B.1) Call Volume**		**(B.2) Put Volume**		**(B.3) Call Vol. + Ret.**		**(B.4) Put Vol. + Ret.**	
PS1-All	0.26	0.40	0.06	0.12	0.49	0.63	0.12	0.24
(*t*-stat)	(2.00)	(2.32)	(0.46)	(0.69)	(2.99)	(2.86)	(0.72)	(1.07)
PS2-All	0.15	0.27	0.06	0.12	0.27	0.40	0.16	0.31
(*t*-stat)	(1.81)	(2.18)	(0.51)	(0.82)	(2.01)	(2.19)	(1.11)	(1.61)
PS1-Options	0.28	0.53	0.22	0.37	0.32	0.65	0.31	0.50
(*t*-stat)	(2.29)	(3.28)	(1.72)	(2.17)	(2.73)	(2.96)	(1.92)	(2.47)
PS2-Options	0.20	0.36	0.24	0.37	0.29	0.48	0.17	0.34
(*t*-stat)	(2.18)	(2.37)	(2.12)	(2.45)	(2.26)	(2.59)	(1.18)	(1.88)
Panel C	**(C.1) DOTM Call**		**(C.2) OTM Call**		**(C.3) ATM Call**		**(C.4) ITM Call**	
PS1-All	0.00	0.05	0.27	0.35	0.32	0.48	0.19	0.25
(*t*-stat)	(-0.03)	(0.24)	(1.98)	(2.01)	(2.53)	(2.63)	(1.28)	(1.44)
PS2-All	0.00	0.05	0.23	0.29	0.22	0.33	0.16	0.26
(*t*-stat)	(0.00)	(0.29)	(1.93)	(1.95)	(1.98)	(1.93)	(1.25)	(1.64)
PS1-Options	0.05	0.18	0.27	0.46	0.29	0.51	0.39	0.51
(*t*-stat)	(0.29)	(0.93)	(1.95)	(2.68)	(2.19)	(2.92)	(2.98)	(3.12)
PS2-Options	0.10	0.23	0.12	0.23	0.28	0.46	0.25	0.35
(*t*-stat)	(0.89)	(1.69)	(1.00)	(1.48)	(2.39)	(2.91)	(2.10)	(2.33)

(*Continued*)

Table 3: (*Continued*)

	Treat-Control		Treat-Control		Treat-Control		Treat-Control	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Max	Sum	Max	Sum	Max	Sum	Max	Sum
Panel D	**(D.1) OTM Put**		**(D.2) ATM Put**		**(D.3) ITM Put**		**(D.4) DITM Put**	
PS1-All	0.49	0.64	0.14	0.19	0.06	0.13	-0.21	-0.17
(t-stat)	(3.70)	(3.87)	(1.00)	(1.04)	(0.41)	(0.73)	(-0.88)	(-0.66)
PS2-All	0.36	0.49	0.08	0.14	0.05	0.08	0.00	0.03
(t-stat)	(2.97)	(3.20)	(0.63)	(0.86)	(0.38)	(0.51)	(-0.01)	(0.15)
PS1-Options	0.38	0.45	0.14	0.29	0.23	0.36	0.32	0.33
(t-stat)	(2.59)	(2.64)	(0.91)	(1.53)	(1.66)	(2.11)	(1.57)	(1.37)
PS2-Options	0.49	0.60	0.08	0.23	0.17	0.23	0.26	0.29
(t-stat)	(3.79)	(3.93)	(0.65)	(1.35)	(1.32)	(1.45)	(1.58)	(1.42)

Description: In this table, we report results for the measures of informed trading activity, Sum and Max. In Panel A, we examine stock returns and volume, options volume, and implied volatility. In Panel B, we examine call and put options volume separately. In Panels C and D, we stratify call and put options volume by moneyness. For each of the dependent variables, we fit a normal regression model over the 90-day pre-announcement window to compute normal returns. The conditional model contains a constant, day-of-week dummies, and the lagged returns and volume and contemporaneous returns and volume of the market index. In addition, we control for lagged values of the dependent and all independent variables and the VIX price index. Standardized residuals are used to compute the Sum and Max measures. Sum (Max) is measured as the sum (maximum) of all positive standardized residuals over the five pre-event days. For each test, we report the difference in average values between the treatment and control groups, and the results of a t-test for differences in means. The four control groups are constructed using the propensity-score matching technique based on the spinoff probability. We choose the best ($PS1$), and the two best ($PS2$) matches respectively, for both the full sample (All) and the sample with options only ($Options$). Moneyness is defined as S/K, the ratio of the stock price S to the strike price K. DOTM corresponds to $S/K \in [0, 0.80]$ for calls ($[1.20, \infty)$ for puts), OTM corresponds to $S/K \in (0.80, 0.95]$ for calls ($[1.05, 1.20)$ for puts), ATM is defined by $S/K \in (0.95, 1.05)$ for calls ($(0.95, 1.05)$ for puts), ITM is defined by $S/K \in [1.05, 1.20)$ for calls ($(0.80, 0.95]$ for puts), and DITM corresponds to $S/K \in [1.20, \infty)$ for calls ($[0, 0.80]$ for puts).

Interpretation: Comparing abnormal volume or returns of the treatment sample relative to a propensity-matched control sample, using both the Sum and the Max measures, there is evidence of significant informed trading activity in the options market, but less evidence in the stock market. The results are more pronounced for call options than for put options, and for those announcements that are associated with positive abnormal stock returns.

Table 4: Quantification of Informed Trading.

Panel A: # Treatment Firms with Abn. Opt. Vol., % of Total Sample.

10% signif. level	**5% signif. level**	**1% signif. level**
12.14	8.93	3.93

Panel B: # Treatment Firms with Abn. Opt. Vol. in Excess of Matched Firms (%).

	10% signif. level		**5% signif. level**		**1% signif. level**	
	Max	Sum	Max	Sum	Max	Sum
PS1-All	6.79	8.57	4.29	4.64	1.79	1.79
PS2-All	6.07	7.32	3.93	3.93	1.61	1.61
PS1-Options	5.36	4.64	4.29	3.57	1.43	0.71
PS2-Options	6.43	6.43	3.57	3.93	1.61	1.07

Description: In this table, we report the fraction of the sample, in percentage terms, that exhibits statistically significant abnormal trading volume at the 1%, 5%, and 10% significance levels, respectively. Panel A reports the number of treatment firms with abnormal options volume, expressed as a percentage of the total sample. We first calculate the abnormal options volume in event days -5 to -1 in excess of the average options volume from event days -63 to -6 (three months). The cumulative abnormal options volume is the sum of the abnormal volumes in days -5 to -1. Assuming no serial correlation, the standard deviation of the cumulative abnormal volume is then $\sqrt{5}\sigma$, where σ is the standard deviation of options volume between days -63 and -6. In Panel B, we report the number of treatment firms with abnormal options volume in excess of a randomly matched control group, expressed as a percentage of the total sample, using both the *Sum* and *Max* measures. We report the results for a normal regression model, computed over the 90-day pre-announcement window to compute normal returns: the conditional model contains constant, day-of-week dummies, and lagged returns and volume and contemporaneous returns and volume of the market index. It also controls for lagged values of the dependent and all independent variables and the VIX price index. Standardized residuals are used to compute the Sum and Max measures. Sum (Max) is measured as the sum (maximum) of all positive standardized residuals over the five pre-event days. The four control groups are constructed using the propensity-score matching technique based on the spinoff probability. We choose the best ($PS1$), respectively the two best ($PS2$) matches, for both the full sample (All) and the sample with options only ($Options$).

Interpretation: Approximately 9% of all SP events exhibit unusual trading activity in the pre-announcement period at the 5% statistical significance level. At the 5% significance level, the number of treatment firms with abnormal options volume in excess of a randomly matched control group represents about 4%-5% of the total sample.

Table 5: Abnormal Options Volume by Deal Characteristics.

	(1) Max	(2) Sum	(3) Max	(4) Sum	(5) Max	(6) Sum
Panel A: Deal Type						
	Completed (N=214)		Withdrawn (N=62)		Complet.-Withdr.	
PS1-All	0.38	0.51	0.04	0.20	0.35	0.31
(t-stat)	(2.91)	(2.82)	(0.13)	(0.55)	(1.16)	(0.76)
Panel B: Diversified vs. Focused Deals						
	Same Industry (N=128)		Different Industry (N=148)		Same-Diff. Industry	
PS1-All	0.14	0.17	0.45	0.67	-0.31	-0.50
(t-stat)	(0.75)	(0.75)	(2.86)	(2.93)	(-1.31)	(-1.55)
Panel C: Deal Value						
	Low Deal Value (N=59)		High Deal Value (N=58)		Low-High Deal Value	
PS1-All	0.27	0.20	0.51	0.87	-0.25	-0.67
(t-stat)	(0.93)	(0.52)	(2.37)	(2.74)	(-0.69)	(-1.34)
Panel D: Deal Distance						
	Low Distance (N=59)		High Distance (N=58)		Low-High Distance	
PS1-All	0.06	0.35	0.82	1.02	-0.76	-0.68
(t-stat)	(0.28)	(1.00)	(3.11)	(2.87)	(-2.18)	(-1.37)
Panel E: Conglomerate Discount						
	Low Discount (N=46)		High Discount (N=46)		Low-High Discount	
PS1-All	0.90	1.27	0.47	0.59	0.43	0.69
(t-stat)	(3.17)	(3.56)	(1.68)	(1.53)	(1.07)	(1.30)

(*Continued*)

Description: In this table, we report the results for the treatment effect, i.e., the differences in measures of informed trading between the treatment and control groups, using the Sum and Max measures for aggregate options volume and subsamples stratified by deal characteristics, using a normal regression model over the 90-day pre-announcement window to compute normal returns. The conditional model uses a constant, day-of-week dummies, and the lagged returns and volume and contemporaneous returns and volume of the market index. It also controls for lagged

Table 5: (*Continued*)

Description: values of the dependent and all independent variables and the VIX price index. For each test, we report the average values separately for the treatment and control groups, their differences, and the results for the t-test for differences in means. The four control groups are constructed using the propensity-score matching technique based on the spinoff probability. We report the best ($PS1$) matche for the full sample (All). In Panel A, we separate completed and withdrawn deals. In Panel B, we separate the results for focused and diversified deals, where a deal is classified as diversified if the parent has a different two-digit SIC code than the divested firm. In Panel C, we report results for the bottom and top quintiles of deal size, measured as the transaction value relative to the parent's market value of common equity. In Panel , we separate results for the bottom and top quintiles of geographical distance between the parent and the subsidiary using the parent and subsidiary zip codes. In Panel E, we separate the results for the bottom and top terciles of the conglomerate discount, where the conglomerate discount is measured as the logarithm of the ratio of the sales-weighted average of the Tobin's q values (ratio of market value of assets to book value of assets), computed for all industry segments of the parent firm, to the parent's observed Tobin's q. T-test statistics are reported below the measures of informed trading and are based on standard errors that are corrected for both cross-sectional and time-series correlation.

Interpretation: There are statistically significant greater measures of unusual options trading activity in the samples of completed deals, diversified SPs, larger deals, and deals that are ex ante considered to have a lower conglomerate discount. However, the differences across groups are not statistically significant, based on the results in columns (5) and (6).

Table 6: Empirical Evidence of Informed Trading - Abnormal Order Flow.

	(1) Treat-Control Max	(2) Treat-Control Sum	(3) Treat-Control Max	(4) Treat-Control Sum
	A: Stock Order-Flow Imbalance		**B: Option Order-Flow Imbalance**	
PS1-All	0.13	0.21	0.29	0.31
(t-stat)	(1.75)	(1.73)	(2.10)	(1.87)
PS2-All	0.12	0.20	0.24	0.28
(t-stat)	(1.72)	(1.80)	(2.10)	(2.19)
PS1-Options	0.12	0.15	0.32	0.38
(t-stat)	(1.68)	(1.25)	(1.87)	(1.88)
PS2-Options	0.06	0.07	0.22	0.25
(t-stat)	(0.85)	(0.69)	(1.85)	(1.74)

Description: In this table, we report the results for the measures of informed trading activity Sum and Max for the order-flow imbalances in both stock and option volumes. Stock (option) order-flow imbalance is measured as the net difference between customer buy- and sell-initiated stock (delta-adjusted option) volume, scaled by the number of shares outstanding. We fit a normal regression model over the 90-day pre-announcement window to compute normal returns. The conditional model uses a constant, day-of-week dummies, and the lagged returns and volume and contemporaneous returns and volume of the market index. It also controls for lagged values of the dependent and all independent variables and the VIX price index. Standardized residuals are used to compute the Sum and Max measures. Sum (Max) is measured as the sum (maximum) of all positive standardized residuals over the five pre-event days. For each test, we report the difference in average values between the treatment and control groups, and the results of a t-test for differences in means. The four control groups are constructed using the propensity-score matching technique based on the spinoff probability. We choose the best ($PS1$), and the two best ($PS2$) matches respectively, for both the full sample (All) and the sample with options only ($Options$).

Interpretation: Based on intra-day order flows in stocks and options ahead of SP announcements, there is evidence for unusual buying activity in the options market in the period preceding the SP announcements, and less evidence for unusual buying activity in the stock market.

Table 7: Announcement Return Predictability.

	Panel A: *Max* Measure				**Panel B: *Sum* Measure**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	-0.01	0.02	-0.14	0.17	-0.02	0.02	-0.10	0.45
	(-1.01)	(0.92)	(-0.89)	(0.53)	(-1.22)	(1.17)	(-0.59)	(1.47)
RETURN	0.00	-0.02	-0.01	-0.04	0.00	-0.03*	-0.01	-0.05***
	(-0.21)	(-0.68)	(-0.31)	(-1.29)	(-0.39)	(-1.81)	(-0.55)	(-2.91)
STOCKVOLUME	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.02
	(0.99)	(0.45)	(0.63)	(0.71)	(0.59)	(1.24)	(0.14)	(1.07)
IMPL.VOL	0.01	0.00	0.02	0.01	0.01	0.00	0.01*	0.01
	(0.71)	(0.24)	(1.35)	(0.37)	(1.51)	(0.43)	(1.87)	(1.49)
$O-VOLUME$	0.02***	0.03***	0.03***	0.05**	0.02**	0.03***	0.02***	0.04**
	(2.58)	(2.77)	(2.91)	(2.19)	(2.45)	(2.93)	(2.83)	(2.44)
SOI	0.00	0.00	0.00	-0.02	0.00	0.00	0.00	-0.03*
	(0.04)	(0.13)	(0.01)	(-0.53)	(0.42)	(0.12)	(0.27)	(-1.89)
OOI		0.02		0.02		0.21		0.02
		(0.69)		(0.45)		(0.99)		(0.14)
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓
Quarter FE	✓	✓	✓	✓	✓	✓	✓	✓
Controls			✓	✓			✓	✓
N	280	90	165	49	280	90	165	49
Adj. R^2	0.02	0.03	0.08	0.16	0.03	0.05	0.09	0.17

(*Continued*)

Description: In this table, we present estimates of the regression of abnormal SP announcement stock returns on a constant and the different measures of informed trading obtained from the stock and the options market using either the Max (Panel A) or the *Sum* (Panel B) methodology. *Sum* (Max) is measured as the sum (maximum) of all positive standardized abnormal returns over the five pre-event days, where the normal returns are calculated over the three-month pre-announcement window based on a benchmark model that includes a constant, day-of-week dummies, the lagged returns and volume of the market index, and contemporaneous returns and volume of the market index, lagged values of the dependent and all independent variables, and the VIX price index. $RETURN$ refers to the *Sum* and Max measures obtained from abnormal stock returns, $STOCKVOLUME$ from abnormal stock trading volume, $IMPL.VOL$ from excess implied volatility, and $O-VOLUME$ from abnormal aggregate options volume. SOI and OOI denote the stock and options order-flow imbalances. Controls include: $SAME-SIC2$, an indicator equal to one if the parent and divested company have the same two-digit SIC code; $INTERSTATE$ is equal to one if the spun off company is incorporated in a different state to the parent; $VALUE$, the market value of the divestiture relative to the market capitalization of the

Table 7: (*Continued*)

Description: parent firm; the conglomerate discount $DISCOUNT$, measured as the logarithm of the ratio of the sales-weighted average of the Tobin's q values (ratio of market value of assets to book value of assets), computed for all industry segments of the parent firm, to the parent's observed Tobin's q; $CONGLOMERATE$ is equal to one if the parent has multiple business segments with at least one in a different two-digit SIC code ; $GOVERNANCE$, the E-index of Bebchuk *et al.*, 2009, computed based on six corporate governance provisions: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers and charter amendments; $BLOCK$ is equal to one if there exists at least one institutional shareholder that holds more than 5% of the parent's stock; $WAVE$ equals one if a spinoff occurred in the same two-digit SIC code in the previous quarter; $ASSETS$, the natural logarithm of total assets (TA); MB, the ratio of market-to-book equity; $LEVERAGE$ is firm leverage; $PPENT$, total net property, plant, and equipment divided by TA; EPS, earnings-per-share; $WCAP$, the ratio of working capital to TA; RE, retained earnings divided by TA; $CASH$, the ratio of cash to TA; $CAPX$, the ratio of capital expenditure to TA; EMP, the natural logarithm of the number of employees (measured in thousands). N denotes the number of observations, $R2$ is the R-squared of the model. Models (1)-(4) ((5)-(8)) are based on the Max (Sum) measure of informed trading. All specifications include industry and quarter fixed effects (FE). $***$ ($**$, $*$) denotes significance at the 1% (5%, 10%) level.

Interpretation: Only abnormal options volume positively predicts CARs with a statistically significant coefficient at the 5% level. The coefficient of 0.02 implies that a one standard deviation increase in the Max measure for options volume is associated with a 2% greater CAR. All other measures are statistically insignificant.

Table 8: Transaction Costs.

Market	Transaction Costs (bps/cents)	Relative Transaction Costs (%)
Bond	185	64
CDS	34	10
Options	8.4	5
Stock	8	1.54

Description: This table provides the average transaction costs on an absolute (either in bps or in cents) and on a relative (as a percentage of the underlying) basis for the stock, options, CDS, and corporate bond markets. Values for the corporate bond market are from Friewald *et al.*, 2012. We use values for the CDS market from Bongaerts *et al.*, 2011 and Lando and Mortensen, 2005. Metrics for the equity options and stock markets are from Muravyev and Pearson, 2014 and Goyenko *et al.*, 2014.

Interpretation: Transaction costs are lower in the equity market than in the fixed income market. While stocks have lower relative transaction costs than options, options provide greater leverage than stocks.

A Proof for Statistical Inference of Treatment Effects

For each variable $X_{i,t}$, where i is event subscription and t is the event day relative to the SP announcement day, the standardized residuals during the five-day pre-event window follow $i.i.d.$ standard normal distributions $N(0,1)$. Define $Max_i = max\{X_{i,-1},...,X_{i,-5}\}$. Note that:

$$(Max_i < x) = (max\{X_{i,-1},...,X_{i,-5}\} < x) = (X_{i,-1} < x, ...X_{i,-5} < x)$$
$$= \bigcap_{k=-1}^{-5} (X_{i,k} < x).$$

So the cumulative distribution function (CDF) of Max_i is:

$$F(x) = P(Max_i < x) = P(\bigcap_{k=-1}^{-5} (X_{i,k} < x)) = \prod_{k=-1}^{-5} \Phi(x) = \Phi^5(x),$$

where $\Phi(x)$ is the CDF of the standard normal distribution. Royston, 1982 provides an approximation for the expectation of the rth normal order variable out of n variables as $-\Phi^{-1}(\frac{r-0.375}{n+0.25})$. With $r = 1$ and $n = 5$, the expected value of Max_i is 1.18. Also note that:

$$Var(Max_i) = Var(max\{X_{i,-1},...,X_{i,-5}\}) \leq \sum_{k=-1}^{-5} Var(X_{i,k}) = 5.$$

The treatment effect is the difference between the Max_i of the SP firm and that of the control firm. Since Max_i is $i.i.d$ in the treatment and control groups, the expectation of the treatment effect is zero and the variance is less than twice the variance of Max_i, 10. Given the well-defined mean and limited variance, the treatment effect on Max_i converges to a normal distribution with zero mean under Lindeberg-Levy Central Limit Theory (CLT). A Student's t-test with unknown variance can therefore be performed on the mean treatment effect.

Define $Sum_i = \sum_{t=-1}^{-5} max\{0, X_{i,t}\} = \sum_{t=-1}^{-5} \frac{X_{i,t}+|X_{i,t}|}{2}$. The expectation of Sum_i is calculated as:

$$E[Sum_i] = E[\sum_{t=-1}^{-5} \frac{X_{i,t} + |X_{i,t}|}{2}] = \frac{5}{2} E[X_{i,t}] = 5 \int_0^{+\infty} x \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} dx = \frac{5}{2\pi}$$
$$\approx 1.99,$$

and the variance is:

$$Var(Sum_i) = E[Sum_i^2] - (E[Sum_i])^2 = E[(\sum_{t=-1}^{-5} \frac{X_{i,t} + |X_{i,t}|}{2})^2] - (\frac{5}{2\pi})^2$$
$$= \frac{5}{2}E[(X_{i,t})^2] + \frac{C_5^2}{2}E[|X_1||X_2|] - \frac{25}{\pi} = \frac{5}{2} + \frac{10}{\pi} - \frac{25}{\pi} \approx 1.70.$$

The treatment effect on Sum_i is the difference of Sum_i between the SP firm and the matched control firm. Therefore, the expectation of the treatment effect is zero and the variance is twice the variance of Sum_i. Under Lindeberg-Levy CLT, the treatment effect on Sum_i also converges to a normal distribution with zero mean and we can test the sample mean using the Student's T-test.

Table A-1: Summary Statistics of Characteristics for Treatment and Control Groups.

	Treatment	**Control**							
		All Deals				**Parents with Traded Options**			
	PS0	**PS1**		**PS2**		**PS1**		**PS2**	
CONGLOMERATE	0.493	0.514	-0.021	0.516	-0.023	0.543	-0.050	0.536	-0.041
DISCOUNT	0.146	0.163	-0.017	0.126	0.020	0.127	0.019	0.128	0.020
GOVERNANCE	9.283	9.082	0.201	9.139	0.144	9.258	0.025	9.275	0.001
BLOCK	0.671	0.636	0.036	0.643	0.029	0.675	-0.004	0.670	0.004
WAVE	0.321	0.336	-0.014	0.359	-0.038	0.346	-0.025	0.350	-0.030
ASSETS	8.395	8.311	0.084	8.323	0.073	8.251	0.144	8.263	0.127
MB	1.623	1.698	-0.083	1.661	-0.465	1.709	-0.116	1.675	-0.041
LEVERAGE	0.308	0.296	0.017	0.298	0.007	0.300	-0.001	0.290	0.012
PPENT	0.244	0.273	-0.029	0.259	-0.015	0.253	-0.009	0.246	-0.003
EPS	0.332	0.319	0.012	0.389	-0.057	0.290	0.042	0.316	0.015
WCAP	0.143	0.165	-0.022	0.166	-0.023	0.137	0.005	0.145	-0.001
RE	0.015	0.110	-0.095*	0.092	-0.077*	0.104	-0.089**	0.110	-0.094**
CASH	0.028	0.030	-0.002	0.031	-0.002	0.023	0.005	0.024	0.004
CAPEX	0.013	0.014	-0.001	0.014	-0.001	0.013	0.000	0.013	0.000
EMP	9.221	9.201	0.020	9.188	0.032	9.196	0.025	9.188	0.032
RET	0.026	0.060	-0.034	0.055	-0.029	0.036	-0.010	0.031	-0.003
VOLATILITY	0.436	0.454	-0.017	0.449	-0.013	0.449	-0.013	0.457	-0.021
TURNOVER	0.773	0.722	0.051	0.702	0.071	0.799	-0.026	0.797	-0.025

(*Continued*)

Description: In this table, we compare the sample characteristics of the treatment ($PS0$) and propensity-matched control groups ($PS1$ and $PS2$). $PS1$ ($PS2$) defines the control group using the first best match (first two best matches), constructed either from the entire SP population, or from the subsample of deal-quarters with options. $CONGLOMERATE$ is a dummy variable equal to one if the parent has multiple business segments of which at least one has a different two-digit SIC code than the parent company; $DISCOUNT$ denotes the conglomerate discount measured as the logarithm of the ratio of the sales-weighted average of the industry-median Tobin's q values (ratio of market value of assets to book value of assets), computed for all industry segments of the parent firm, to the parent's observed Tobin's q; $GOVERNANCE$ is the E-index of Bebchuk *et al.*, 2009, computed based on six corporate governance provisions: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers and charter amendments; $BLOCK$ is an indicator variable equal to one if there is at least one institutional shareholder that holds more than 5% of the parent's stock; $WAVE$ is a dummy variable that equals one if a spinoff occurred in the same two-digit SIC code in the previous quarter; $ASSETS$ denotes the natural logarithm of total assets; MB is the ratio of market-to-book equity; $LEVERAGE$ is firm leverage; $PPENT$ is defined as total net property, plant, and equipment divided by total assets; EPS denotes earnings-per-share; $WCAP$ is the ratio of working capital to total assets; RE is retained earnings divided by total assets; $CASH$ is the ratio of cash to total assets; $CAPEX$ is the ratio of capital expenditure to total assets; EMP is the natural logarithm of the number of employees (measured in thousands). All balance sheet variables are lagged by one quarter relative to the quarter

Table A-1: (*Continued*)

Description: of the spinoff announcement. RET is the parent's past quarter's stock price performance, measured as the sum of the past quarter's log stock returns; $VOLATILITY$ denotes the past quarter's equity volatility, measured as the annualized standard deviation of the past quarter's daily returns; $TURNOVER$ is defined as the average trading volume divided by the number of shares outstanding in the previous quarter. $***$ ($**$, $*$) denotes significance at the 1% (5%, 10%) level.

Interpretation: The sample characteristics of the treatment group are not significantly different from those of the propensity-matched control groups, suggesting that the treatment and control groups are well matched.